

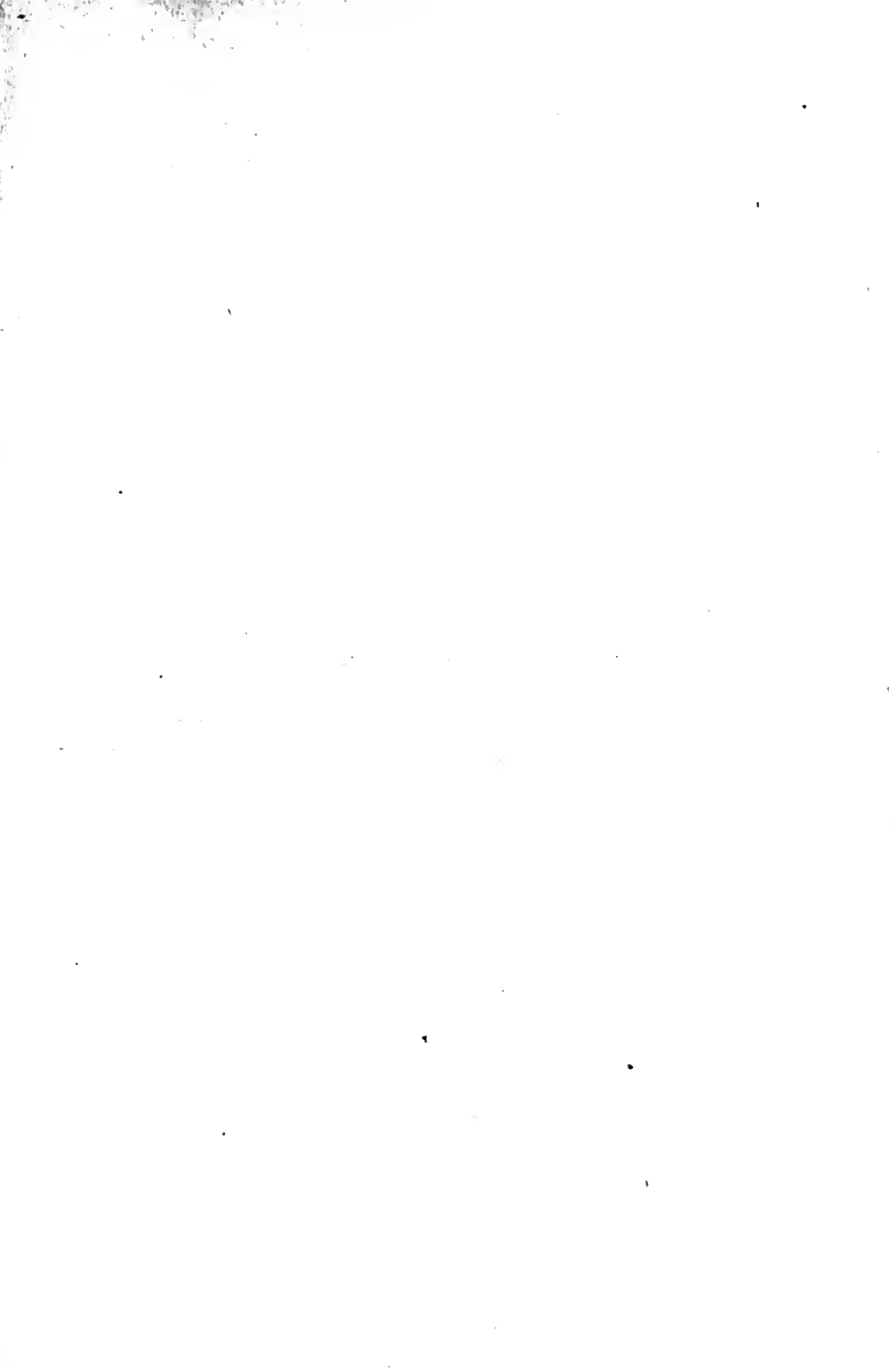


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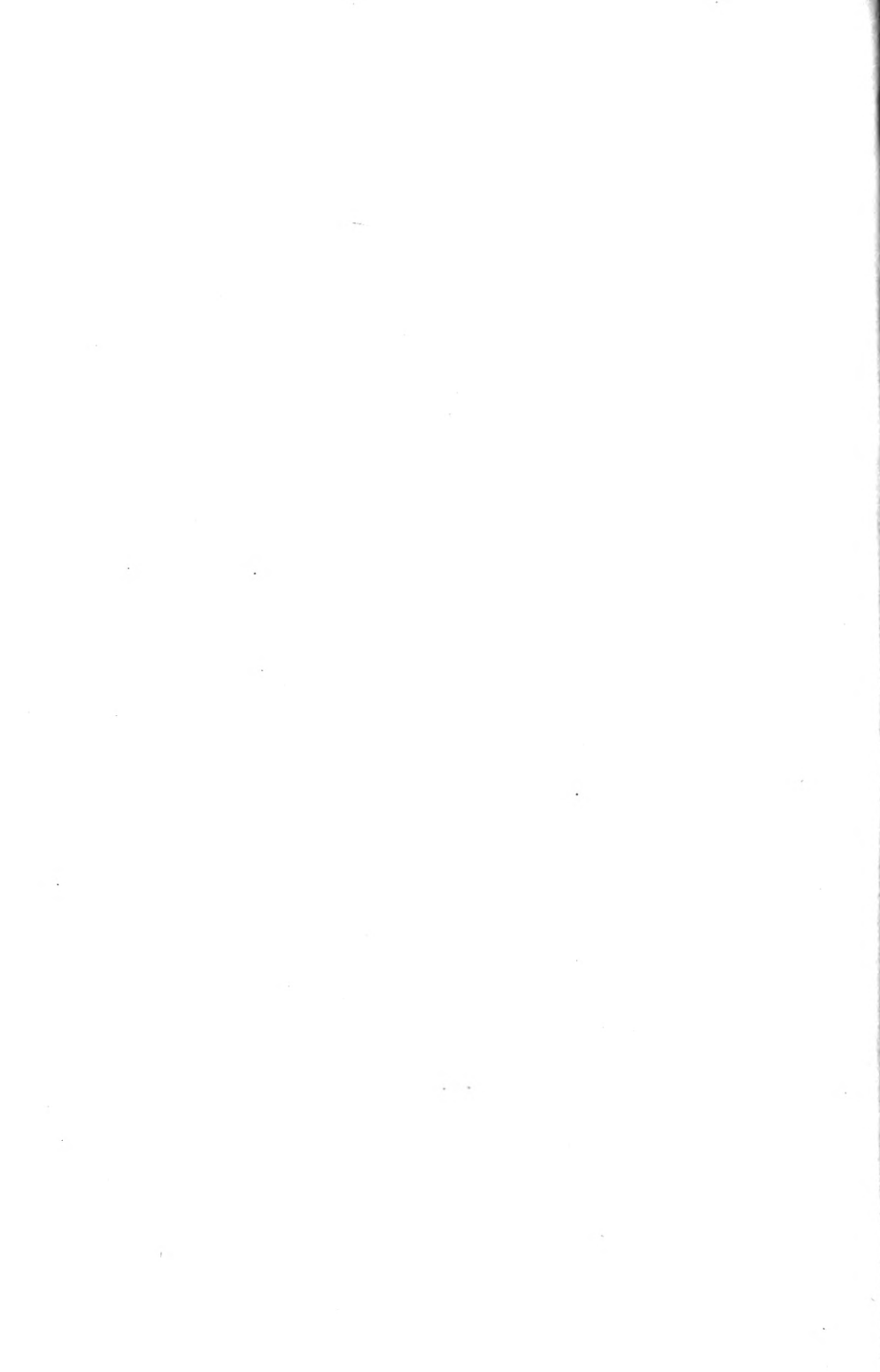
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OBSERVATIONS ON CONGENITAL HYPERTROPHY ON THE PYLORUS.*

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THE clinical material on which the following remarks are founded consists in 100 consecutive cases of congenital pyloric hypertrophy which have been treated in hospital and private practice during the last twenty-five years (February 1894 to February 1919). A table of these is appended, and care has been taken to include in it only those cases in which the diagnosis seemed beyond a doubt. Of the 58 cases which ended fatally, 45 were examined post mortem; and, of the remaining 13 in which this was not allowed, the condition of the pylorus had been ascertained during an operation in four instances.

The aim of the paper is to sum up briefly the writer's personal experience of a large number of cases, many of which were studied for an unusually long time. The subjects specially dealt with comprise the family history and complications, the causation of the muscular hypertrophy and of the symptoms, the natural course of the disease under medical and surgical treatment, the symptoms and choice of treatment in different types of the disease, the diagnosis, especially that between pyloric hypertrophy and the so-called "pyloric spasm," the difference in the prognosis in hospital and private cases, and the subsequent health of the patients who recover.

Family Occurrence.—In one of the cases (No. 11) the father had suffered as a baby from similar symptoms. In another (No. 83) the mother's brother had died in infancy from what

* Reprinted from *Contributions to Medical and Biological Research; dedicated to Sir William Osler*. New York: Paul B. Hoeber, 1919, vol. ii. 1010.

John Thomson

certainly seems to have been congenital pyloric hypertrophy. The father and paternal uncle of No. 13, who were Jews, had practised rumination since childhood.

In four instances there were two members of a family affected, namely Nos. 14 and 34; 24 and 29; 33 and 36; and 38 and 54. One of the patients (No. 86) was a twin, the other twin being normal.

Complications.—In No. 36 there was a congenital heart-lesion. One patient (No. 46), whom I saw in consultation with Dr D. B. Lees, was the subject of achondroplasia, and died about a year later from hydrocephalus—long after the stomach symptoms had ceased. With these exceptions, no accompanying congenital malformations or diseases were observed.

One child (No. 96) was found on admission to hospital to be suffering from acute hæmorrhagic nephritis which was rapidly fatal. Another (No. 27) died from broncho-pneumonia ten days after admission to hospital.

The complication most to be feared is acute infective diarrhœa. When this occurs, as it is apt to do in a hospital ward during summer or autumn, the risk is very great; for children with pyloric hypertrophy seem to be peculiarly liable to suffer seriously from this form of infection. Three of the hospital cases (Nos. 54, 56, and 62) died from it while they were improving rapidly under medical treatment; one (No. 60), also treated medically, died two months after all his pyloric symptoms had ceased; and a third (No. 20), a month after a successful gastro-enterostomy.

In one case (No. 47) the patient, who ultimately did well, suffered for about three years after gastro-enterostomy from recurrent attacks of vomiting.

Causation of the Muscular Hypertrophy and of the Symptoms.—The extended clinical and pathological experience which these cases have afforded has served to confirm former conclusions regarding its primarily nervous origin, although this does not seem to be the only cause of the obstruction.

When we examine the essential *structural* change that is present, we find that it is definitely restricted to the upper part of the alimentary tract and consists simply in a high degree of true hypertrophy of the entire muscular coat of the pylorus and adjacent stomach-wall, and a lesser amount of the same in the cardiac end of the stomach and in the œsophagus. The other local changes present, such as dilatation of the stomach and

Congenital Hypertrophy on the Pylorus

œsophagus, gastric catarrh, and general wasting of the body, are obviously secondary results of the pyloric obstruction.

The essential abnormality of *function* may be said to be similarly localised. It consists mainly in an ill-timed abnormally forcible and prolonged contraction of the pyloric muscle, which prevents the food passing into the bowel, and so accounts for the starvation and wasting, the thirst and drying-up of the tissues, and the scantiness of the urine and fæces. In conjunction with the muscular hypertrophy of the stomach-wall it also explains the forcible vomiting.

While these facts can scarcely be disputed, there is still some difference of opinion regarding the origin of the muscular hypertrophy. Is the abnormal action of the pylorus and other parts a secondary phenomenon, due to the muscular coat being primarily affected by a simple congenital redundancy of growth, as Hirschsprung, Cautley, and others have suggested? Or, is the functional abnormality to be regarded as the primary element in the process—the muscle being hypertrophied merely because, from an early period of its development, it has been worried into overgrowth by constantly recurring overaction, such as would result from even a slight degree of habitual inco-ordination?

As these two hypotheses have been fully dealt with in a former paper¹ they need not be further discussed here. I may, however, give a brief statement of the second of them, which seems to me altogether the more likely of the two.

It is known that the normal foetus swallows a considerable quantity of amniotic fluid during intra-uterine life; and, as this implies a certain amount of co-ordinated muscular action of the stomach and pylorus, it is believed that the supposed inco-ordination between these parts begins when the fluid first passes through them. There is reason to believe, however, that the muscular action may not at this period be very vigorous or continuous, and that therefore, by the time the child is born, only a small degree of hypertrophy will have occurred. After birth, when regular feeding has begun, the force of the muscular action and the inco-ordination will tend to increase so that the hypertrophy will progress much more rapidly than during intra-uterine life. It is in accordance with medical, surgical, and pathological experience that the pyloric tumour does grow larger and harder while the active symptoms continue. This is just what might be expected, for, as John Hunter pointed out

John Thomson

long ago, a tendency to hypertrophy as the result of repeated forcible contractions is "a property of all muscles" and is greater in involuntary than in voluntary muscles. It is also extremely probable that tissue-growth of this sort is specially active in early infancy.

In the blocking of the pylorus there are two factors at work. There is first the abnormal muscular contraction, and, secondly, the mechanical effect of the increased bulk of the muscular tissue. This second factor is worthy of more attention than it has hitherto received.

When one contrasts a transverse section of a normal pylorus



FIG. 1.—Transverse Section of Normal Pylorus near the Duodenum, $\times 4$ Diam. Child of Nine Weeks.



FIG. 2.—Transverse Section of Hypertrophied Pylorus near the Duodenum, $\times 4$ Diam. Child of Nine Weeks.

with one from a case of pyloric hypertrophy (Figs. 1 and 2), the degree to which the mere bulk of the hypertrophied muscle must diminish the pyloric lumen is obvious.

The muscular coat, as we have seen, grows quickly, but the peritoneal tube enlarges comparatively slowly with the general growth of the body, and is incapable of more than a moderate distension. The rapidly thickening muscle, therefore, presses more and more inwards as it grows, and the tube of mucous membrane is elongated and increasingly narrowed. The stage at which the symptoms become typical in any case probably depends mainly on when the muscular layer has become so thick that, even during relaxation, it seriously embarrasses the functional opening of the canal for the passage of food. As the

Congenital Hypertrophy on the Pylorus

rate of increase of the muscular hypertrophy varies in different children, there is a corresponding difference in the age at which severe obstructive symptoms occur. This is the apparent explanation why the violent vomiting sets in as early as the seventh or eighth day of life in some cases, while in others it does not occur until the sixth or eighth week.

The Natural Course of Recovery from the Disease.—In considering the question of the treatment of pyloric hypertrophy, we have to bear in mind an important fact regarding its natural history which has been strongly emphasised by Robert Hutchison—that the disease is self-limited, in the sense that the pyloric lumen will eventually open up spontaneously and the child recover completely, provided he does not die in the process. When such spontaneous recovery occurs, we know from post-mortem experience that the muscular coat remains thickened for a long time, although its action has become gradually normal. Probably the muscular hypertrophy slowly lessens when the tendency to spasm has ceased, and doubtless the peritoneal tube goes on steadily widening also in the course of growth, so that the lumen of the pylorus becomes less and less compressed; ultimately, the channel having become large enough for practical purposes, the passage of food takes place normally.

This natural opening-up of the lumen is usually a protracted, and often rather a risky process. Its progress is best estimated by watching the child's weight, which should if possible be taken daily throughout the illness. How it usually proceeds is seen in the accompanying series of weekly charts of Cases 69, 78, and 80 (Figs. 3, 4, and 5). These show the obstinate manner in which the weight often refuses to go up for many weeks after the medical treatment has begun, and the steadiness and rapidity with which it rises, once the pyloric lumen has begun to widen. Evidently what we may expect from medical treatment in most cases, is not so much that we can greatly hasten the opening of the passage by what we do, as that we may be able to relieve it just sufficiently to keep the child alive, in spite of the continuance of the obstruction, until the natural process of recovery has had time to occur.

If the pyloric lumen is efficiently opened up by a surgical operation, however, the gain in weight usually sets in rapidly, as is seen in the weight-charts of Nos. 8, 81, and 90 (Figs. 6 to 8). Occasionally, as in No. 67 (Fig. 9), the channel has not

The graph shows the 'Special Enrollment Program' from November to May. The x-axis is labeled with months and days. The y-axis has multiple scales for each series: U1 (solid line with dots), U2 (dashed line with dots), and U3 (dotted line with dots). A vertical line at day 12 is labeled 'Special Enrollment Program'.

Month	Day	U1 (Solid)	U2 (Dashed)	U3 (Dotted)
Nov	1	10	10	10
Nov	2	10	10	10
Nov	3	10	10	10
Nov	4	10	10	10
Nov	5	10	10	10
Nov	6	10	10	10
Nov	7	10	10	10
Nov	8	10	10	10
Nov	9	10	10	10
Nov	10	10	10	10
Nov	11	10	10	10
Nov	12	10	10	10
Nov	13	10	10	10
Nov	14	10	10	10
Nov	15	10	10	10
Nov	16	10	10	10
Nov	17	10	10	10
Nov	18	10	10	10
Nov	19	10	10	10
Nov	20	10	10	10
Nov	21	10	10	10
Nov	22	10	10	10
Nov	23	10	10	10
Nov	24	10	10	10
Nov	25	10	10	10
Nov	26	10	10	10
Nov	27	10	10	10
Nov	28	10	10	10
Nov	29	10	10	10
Nov	30	10	10	10
Nov	31	10	10	10
Dec	1	10	10	10
Dec	2	10	10	10
Dec	3	10	10	10
Dec	4	10	10	10
Dec	5	10	10	10
Dec	6	10	10	10
Dec	7	10	10	10
Dec	8	10	10	10
Dec	9	10	10	10
Dec	10	10	10	10
Dec	11	10	10	10
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Dec	16	10	10	10
Dec	17	10	10	10
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Dec	21	10	10	10
Dec	22	10	10	10
Dec	23	10	10	10
Dec	24	10	10	10
Dec	25	10	10	10
Dec	26	10	10	10
Dec	27	10	10	10
Dec	28	10	10	10
Dec	29	10	10	10
Dec	30	10	10	10
Dec	31	10	10	10
Jan	1	10	10	10
Jan	2	10	10	10
Jan	3	10	10	10
Jan	4	10	10	10
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Jan	6	10	10	10
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Jan	9	10	10	10
Jan	10	10	10	10
Jan	11	10	10	10
Jan	12	10	10	10
Jan	13	10	10	10
Jan	14	10	10	10
Jan	15	10	10	10
Jan	16	10	10	10
Jan	17	10	10	10
Jan	18	10	10	10
Jan	19	10	10	10
Jan	20	10	10	10
Jan	21	10	10	10
Jan	22	10	10	10
Jan	23			

Weight (g)

Days

Special Time (meal) 10:00

Days	Weight (g)
0	1.5
1	2.5
2	3.5
3	3.5
4	4.0
5	4.5
6	5.0
7	5.5
8	6.0
9	6.5
10	7.0
11	5.5
12	5.0
13	4.5
14	4.0
15	3.5
16	3.0
17	3.5
18	4.0
19	4.5
20	4.0
21	4.5
22	5.0
23	5.5
24	5.0
25	5.5
26	6.0
27	6.5
28	7.0
29	7.5
30	8.0
31	8.5
32	9.0
33	9.5
34	10.0
35	10.5
36	11.0
37	11.5
38	12.0
39	12.5
40	13.0
41	13.5
42	14.0
43	14.5

FIG. 4.—Weight-Chart of Case 78. Medical Treatment.

Congenital Hypertrophy on the Pylorus

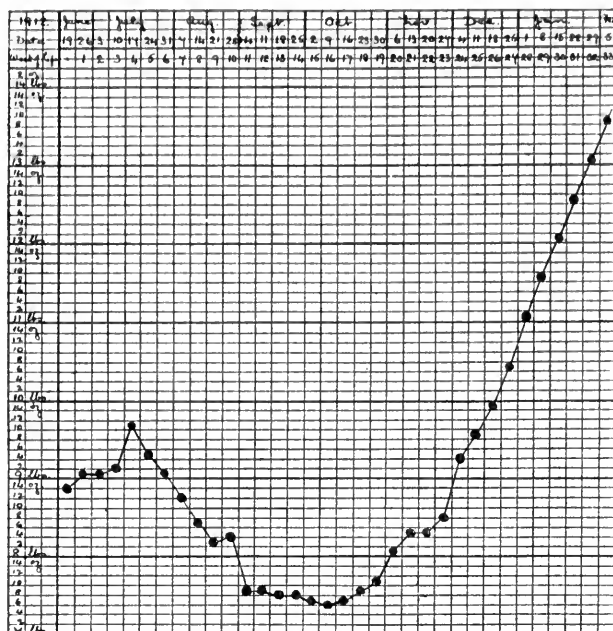


FIG. 5.—Weight-Chart of Case 80. Medical Treatment.

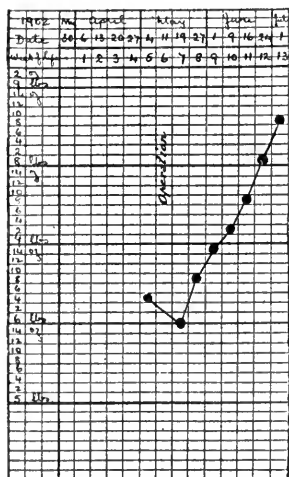


FIG. 6.—Weight-Chart of Case 8.
Loreta's Operation.

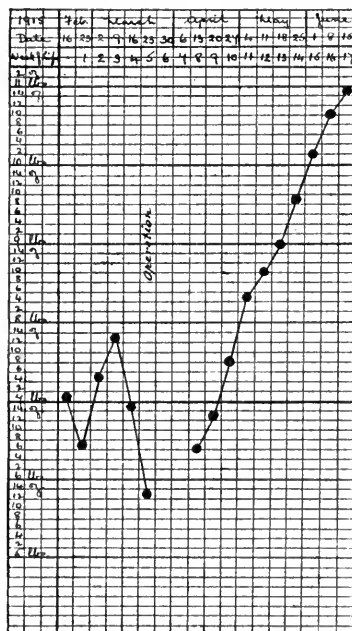


FIG. 7.—Weight-Chart of Case 81.
Loreta's Operation.

John Thomson

been opened sufficiently by the operation, and symptoms of recovery do not begin till many weeks later.

The Symptoms and Treatment of the Different Types of the

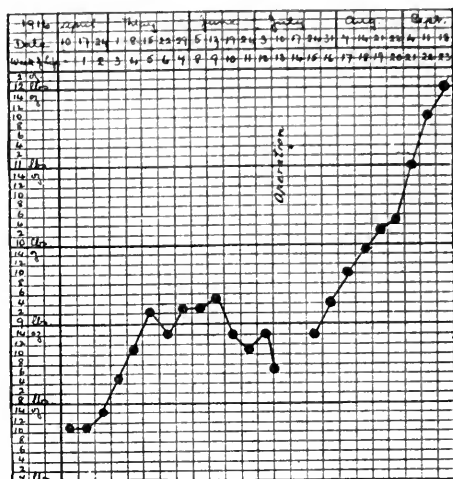


FIG. 8.—Weight-Chart of Case 90. Rammstedt's Operation.

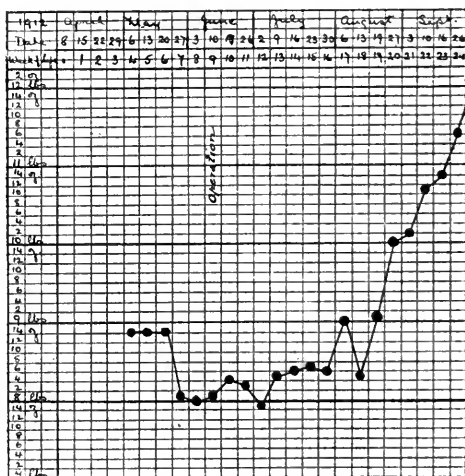


FIG. 9.—Weight-Chart of Case 67. Loreta's Operation.

Disease.—The choice of treatment in cases of congenital pyloric hypertrophy must depend to a large extent on the degree of severity of the case. This is ascertained partly from the history of the symptoms and the present condition of the child, but

Congenital Hypertrophy on the Pylorus

chiefly by investigating, in a preliminary way, the effect that regulation of the diet and stomach-washing have on the vomiting and on the gain in weight. According to the result of these measures we may class the cases as ordinary, acute, and mild.

In the majority of cases of the *ordinary* type there is no vomiting at all during the first week or two of life, and the child gains in weight and vigour quite normally. In some, however, we are told that there has been, even from birth, an occasional "putting up" of a mild character—the milk being gently returned after the breast or bottle has been taken. Often the typical copious "shooting" vomiting sets in quite suddenly without any apparent cause. The date of its onset varies, but it is very rare for it to begin during the first week, if indeed this ever occurs. It commonly starts between the second and fourth, and sometimes only appears as late as the sixth or eighth week. In five of my cases (Nos. 17, 39, 66, 83, and 87) the vomiting was never forcible. Once the violent vomiting begins, it usually continues at short intervals until special treatment is begun to stop it. The rapid loss of weight and the other signs of want of fluid absorption may set in, either before or after the characteristic vomiting.

When the usual symptoms are recognised, the preliminary treatment must begin at once. The size of the feeds should be restricted to 2 oz. or less, and the proportion of curd and fat in them lessened, and they should be given at regular intervals of two or three hours. At the same time the stomach should be washed out with warm water once or twice a day. In this type of case such treatment almost always produces an immediate effect. The vomiting ceases, the child is much more comfortable, and he often begins to gain a little weight, although in most cases the symptoms recur whenever an attempt is made to increase the food given to anything like a normal amount.

Further treatment by hot fomentations over the stomach, and the administration of sedatives such as opium or belladonna, I have never found of much value.

A considerable proportion of hospital cases, and also some private ones, are only brought for treatment after they have undergone a long course of unsuitable feeding, and the child is in a state of collapse, and has dilatation and catarrh of the stomach. Under these circumstances the most urgent indication is to stop all food for at least twenty-four hours, and to give

John Thomson

subcutaneous injections of normal saline solution every four to six hours. The effect of these on the child's strength and comfort is very striking. Most infants bear them well, but there are a few whose subcutaneous tissues are so sensitive that the injections cause them considerable pain. Nutrient enemata are of no use, but it is always well if possible to supplement the subcutaneous injections by enemata of normal saline solution (one or two ounces every six hours). Some children are able for days to retain these without difficulty, but many resent them more than they do the subcutaneous infusions, so that they have to be given up.

If, after two or three weeks, the child is failing to respond to medical treatment, or sooner if he is rapidly losing strength, a surgical operation should be advised, and recent experience has shown that Rammstedt's operation is preferable in every respect to any other form of surgical procedure. It is very important that after the operation, and until recovery has set in, the case should continue to have the closest attention of both the physician and the surgeon.

In the *acute* cases the vomiting usually begins very early, and it sometimes becomes rapidly so urgent that not even a teaspoonful of water can be retained.

The first case of the disease I ever saw was a typical instance of this variety.² The patient (No. 1) thrived fairly well on the bottle for the first ten days of life. Forcible vomiting set in suddenly on the eleventh day and persisted continuously, in spite of careful dieting and lavage, till the child died of exhaustion when he was twenty-eight days old.

This acute type is not often met with. Among the earlier reported cases, indeed, it figured to a fairly large extent, but that was because, at the time, the cases with milder symptoms were usually not recognised as instances of this disease. The fact that few except the worst cases were then diagnosed, accounts for the formerly expressed opinions that the disease is very rare indeed and that it never recovers without operation.

Whenever a case of pyloric hypertrophy proves, by its failure to respond at all to preliminary treatment, to be of this type, it is advisable to have it operated on without delaying longer than is necessary to confirm the diagnosis; and it may occasionally be desirable, in typical cases, to call in the surgeon even before the characteristic visible peristalsis has begun, as was done in Nos. 34, 43, and 47. By doing so, we prevent the

Congenital Hypertrophy on the Pylorus

otherwise probable dilatation and catarrh of the stomach, and avoid further weakening of the patient before the operation. The degree of muscular hypertrophy is always, I think, considerable in these acute cases.

The very *mild* cases show an entirely different clinical picture. They are not at all uncommon, and it is probable that many of them recover with careful dieting only, and without a correct diagnosis having ever been made. It is also probable that, if they were all recognised and suitably treated in the early stages, there would be many fewer dangerous examples of the ordinary type to be treated later. The increasing number of mild cases in recent reports must be remembered when we compare the older with the more recent statistics of the results of treatment. The mild cases are not generally seen by the physician until they are two or three months old, or later. They never require surgical treatment. The following (No. 37) is one of the most typical instances of this variety I have seen.

A girl of eleven weeks, who had thriven well on cow's milk during the first fortnight, but had since been kept rather thin by repeated attacks of what was thought to be dyspeptic vomiting, was found to have a large easily felt pylorus and extremely well-marked visible peristalsis. The recent feeding having been unsuitable in quality and excessive in amount, measured quantities of dilute peptonised milk were ordered. Stomach-washing was also recommended, but for some reason was not carried out. With this simple dieting and no other treatment, the child soon ceased to vomit, and began almost at once to gain weight at the rate of 4 ounces in the week; she is now a strong healthy school-girl. In most of these cases, however, stomach-washing is necessary as well as dieting.

The symptoms in the mild cases differ only in degree from those in the severe ones and the physical signs are also the same, although they may be longer in appearing. The condition of the pylorus and stomach in the few instances in which I have seen them, either post mortem or during an operation, were also practically the same. The mildness of the clinical manifestations, therefore, probably depends not on the pyloric muscle being less hypertrophied than in the worse cases, but on its being less frequently in a state of abnormal contraction, so that it allows a fair amount of food to pass into the bowel.

Diagnosis.—Only in rare instances of the acute type can

John Thomson

a satisfactory diagnosis of pyloric hypertrophy be made from the symptoms alone. Ordinarily we cannot recognise the nature of the case with certainty until we have observed exaggerated visible peristalsis, or made out the enlargement of the pylorus by palpation. In doubtful cases we should also use a stomach-tube to find out whether a measured quantity of food—such as 2 ounces of diluted and peptonised milk—when introduced into the stomach and retained for three or four hours, remains undiminished in amount.

Exaggerated visible peristalsis occurring in a young baby, if it is really well-marked and forcible and accompanied by the characteristic vomiting and other symptoms, is always, so far as my experience goes, pathognomonic of the disease. It is most commonly seen for the first time during the fourth or fifth week, and is very rare indeed before the end of the third. Often, it begins much later, and it may go on vigorously after the vomiting has ceased. At first, it may only appear irregularly at intervals of hours or even of days.

The large hard pylorus can often be felt some time before the visible peristalsis has begun, but in none of my cases was it made out for certain before the eighteenth day of life. The organ sometimes lies too deeply under the liver to be felt even during anæsthesia; and, although it is in an accessible position, it may not be possible to make sure of its presence unless it is in a state of contraction at the time of examination. I have never found it necessary to use X-ray examination as an aid in the diagnosis of this disease.

The cases which are most apt to be mistaken for pyloric hypertrophy are those of an obscure nervous condition which has been usually referred to as "pyloric spasm." Mild instances of this malady are not uncommon and generally give little trouble, because the vomiting and other symptoms are much less severe than those in pyloric hypertrophy, and generally subside rapidly when the feeding is regulated and the stomach washed out. In a few of the cases, however, the symptoms are extraordinarily obstinate, and, in these, the diagnosis, and especially the treatment, may be very troublesome.

The worst cases I have seen have generally been in girls, and it is characteristic of the condition that the child often cries a great deal as if in pain, which children with pyloric hypertrophy rarely do. The vomiting usually begins soon after birth, but does not become projectile until some time between

Congenital Hypertrophy on the Pylorus

the end of the second and the sixth week. Its character differs somewhat from that in pyloric hypertrophy. It generally occurs after each feeding, and the whole stomach-contents are either forcibly rejected at once, or the organ is emptied by successive less severe efforts. When the stomach-tube is used after vomiting has taken place, little or no residue of food is found in the stomach, and there is no evidence of gastric dilatation or hypertrophy. Occasionally, before vomiting occurs, the outline of the stomach stands out distinctly, but it never shows the characteristic vigorous peristalsis. The motions and the urine are usually scanty, but slight attacks of diarrhoea are quite common.

The treatment of these cases requires the greatest care and perseverance. Suitable regulation of the diet is, of course, necessary, and stomach-washing should be regularly carried out; but often neither the one nor the other has any strikingly beneficial effect on the habitual return of the meals. The most useful treatment, in my experience, has been the cautious use of tincture of opium, beginning with doses of m. $\frac{1}{40}$ and rapidly increasing to m. $\frac{1}{10}$ or even m. $\frac{1}{5}$. Under this the vomiting gradually stops and the weight increases. If the mother is careful, the case often does better at home than in hospital, and home treatment is also preferable because these cases, like those of pyloric hypertrophy, are apt to die if they contract infective diarrhoea. On post-mortem examination, the pylorus and stomach are found to be quite normal.

Cases of congenital narrowing of the second part of the duodenum with saccular dilatation of its first portion are sometimes mistaken for pyloric hypertrophy. In this condition, visible gastric peristalsis is sometimes seen, but it is not very forcible. It may also appear in the first week of life, which that in pyloric hypertrophy never does. The vomiting, also, is not forcibly projectile and the child is feeble, and does not thrive well during the first few weeks, as cases of pyloric hypertrophy almost invariably do.

Mortality with Different Forms of Treatment in Hospital and in Private Practice.—Out of the 100 cases, 42 recovered, and 58 died either of the disease or of complications.

Operations were performed in 39 cases; of these 16 (*i.e.*, 41 per cent.) recovered, and 23 (*i.e.*, 59 per cent.) died. The operations were of various kinds. Pylorotomy and pyloroplasty were done each in 1 case, and both patients died; gastro-enterostomy in 12 children, of whom 3 recovered (*i.e.*, 25 per

John Thomson

cent.); divulsion of the pylorus (Loreta's operation) in 18, with 7 recoveries (*i.e.*, 38.9 per cent.); in 2 others, Loreta's operation failed to relieve the symptoms and was therefore followed by gastro-enterostomy, after which both patients made a good recovery; simple division of the pylorus muscle, without stitching (Rammstedt's operation), was done in 5 cases, with 4 recoveries (*i.e.*, 80 per cent.). The cases which recovered were all operated on by Sir Harold Stiles, with the exception of Nos. 95 and 97, in which the operations were performed by Mr A. P. Mitchell and Mr John Fraser respectively.

Of the 61 cases in which no operation was done, 1 (No. 96) died a few days after admission to hospital from acute nephritis of unknown origin, and 6 others (Nos. 6, 13, 17, 32, 94 and 100), who were in a state of extreme collapse when first seen, died rapidly from exhaustion, most of them within forty-eight hours and one on the fifth day. Of the remaining 54 cases that were medically treated, 26 (*i.e.*, 48 per cent.) recovered; and 28 (*i.e.*, 52 per cent.) died. In 3 of the latter, death was caused by infective diarrhoea.

The most remarkable thing about the mortality statistics is the striking difference between the results obtained in hospital and those in private practice. For we find that the total mortality of the 28 hospital cases which were operated on was 75 per cent. (21 deaths), and that of the 11 private cases 18.2 per cent. (2 deaths). In the same way, if we exclude the 7 cases which died within a few days of being first seen and before the treatment could be properly begun, we find that while the 31 hospital cases which were medically treated show a mortality of 74.2 per cent. (23 deaths), that of the 23 cases similarly dealt with in private practice was only 21.7 per cent. (5 deaths).

There are at least three obvious reasons for this great difference. The first of these is the state of debility in which many of the hospital cases were on admission, owing to previous injudicious feeding. This had set up gastric catarrh and dilatation, sometimes with diarrhoea, and had lowered the child's resistance. In former years, the nature of the case had rarely been recognised before the patient was brought to the hospital. The second is the danger of infective diarrhoea, which sometimes occurs in hospital and practically never in private practice. The third reason is that it is seldom possible to give anything like the same amount of medical and nursing attention to the hospital cases as in private practice. In the latter, one has

Congenital Hypertrophy on the Pylorus

usually been able, when the case was a severe one, to arrange for the child to be looked after both by day and at night by specially competent nurses, who have given their whole time and attention to him. I have also made a point of doing the washing-out of the stomach myself, or having it done by another medical man. This I believe to be important, for it not only results in the washing-out being better done, but also often in information being obtained which may be most helpful in the regulation of the diet. If the lavage is carried out by nurses, I am convinced that this may considerably lessen the chance of the child's recovery.

Condition in After-life of the Patients who Recover.—Of the 42 children who recovered, 5 (Nos. 15, 20, 46, 60 and 78) have since died from various causes, and 4 (Nos. 30, 41, 48 and 68) who were doing well when last seen, have been lost sight of. During January and February of this year I have been able to see a number of the remaining 33 patients and have had reports on all the others, either from their medical attendants or from relatives. The present ages of these children vary from ten months to 16 $\frac{3}{4}$ years. The majority, doubtless owing to the extra care which their mothers have taken of them, are above the average in development and vigour; none shows any signs of serious gastric derangement. Apparently the danger to life and even to health in this disease is only temporary, and children who survive it in infancy are in no way handicapped thereby in after-life. Those who were operated on are now apparently as well as the others who were medically treated.

Mr J. H. Nicoll allows me to mention that Dr John Ritchie's patient, on whom he performed Loreta's operation in 1899, and who was the first successful case of operation for this disease in Great Britain,³ was examined for the army last year and passed as A 1.

BIBLIOGRAPHY.—¹ "On Defective Co-ordination in Utero as a Probable Factor in the Causation of Certain Congenital Malformations," *British Medical Journal*, ii. 678. ² *British Medical Journal*, 1895, ii. 711, and *Edinburgh Hospital Reports*, 1896, iv. 116. ³ *British Medical Journal*, 1900, ii. 571.

Table of 100 Cases of Congenital Hypertrophy of the Pylorus.

Number of Case.	Date First Seen.	Sex.	Hospital or Private Patient.	Age in Days when First Seen.	Age in Days at Onset of Foreible Vomiting.	Order of Child in Family	If Operated on.	Nature of Operation.	Recovery or Death.	If Examined P. M.	Remarks.	Age in Years in Feb. 1919.
1	Feb. 1894	M	P	18	11	9	O	.....	D	X	Very acute case	..
2	Mar. 1896	M	P	66	28	4	O	.....	D	X	.....	..
3	April 1896	F	P	27	28	2	O	.....	D	X	.....	..
4	Feb. 1900	F	H	52	?	6	X	Pylorotomy	D	X	.....	..
5	Mar. 1900	M	P	35	14	1	X	Gastro-Enterostomy	D	X	.....	..
6	Mar. 1900	F	H	49	28	2	O	.....	D	X	Collapse on admission. Convulsions. Death within two days	..
7	Mar. 1902	F	H	24	12	3	X	Loreta	D	N	.....	16 ³ / ₄
8	April 1902	M	H	32	17	1	X	"	Rec.	..	Now healthy and vigorous. In regular work	16 ¹ / ₂
9	July 1902	M	P	54	33	1	X	"	Rec.	..	Now a strong, healthy public-school boy. No indigestion	16 ¹ / ₂
10	Nov. 1902	M	H	38	9	3	X	"	D	X	.....	..
11	Nov. 1902	M	P	32	28	1	O	.....	Rec.	X	.....	16 ¹ / ₂
12	April 1903	M	H	25	?	9	X	"	D	X	Now strong and healthy	..
13	April 1903	M	H	123	14	4	O	.....	D	X	.....	..
14	May 1903	M	P	34	32	1	X	"	D	X	Collapse on admission. Died within a few hours	..
15	June 1903	M	P	69	47	3	X	Loreta and Gastro-Enterostomy	Rec.	..	Constant high temperature (over 104° F.) and diarrhoea before operation	..
16	April 1904	M	P	49	?	1	X	Gastro-Enterostomy	Rec.	..	Died two years after from septic infection of throat	14 ³ / ₄
17	Aug. 1904	M	P	81	never forcible	4	O	.....	D	X	Now a healthy schoolboy	..
18	Aug. 1904	F	H	42	7	1	X	Gastro-Enterostomy	D	N	Collapsed and died after a series of convulsions	..

Congenital Hypertrophy on the Pylorus

19	Sept. 1904	M	H	53	21	3	X	Gastro-Enterostomy	Rec.	...	Now a big, strong boy. Splendid appetite, never ill	14½
20	Oct. 1904	M	H	49	21	4	X	"	Rec.	X	Died one month later, from infective diarrhoea	...
21	Oct. 1904	M	H	49	?	4	X	"	D	X	Collapsed and died at end of operation	...
22	Feb. 1905	F	H	36	14	4	X	"	D	X	.....	...
23	Mar. 1905	M	H	23	16	2	X	Loreta	D	O	.....	...
24	Mar. 1905	M	H	99	25	2	X	.....	D	O	.....	...
25	May 1905	M	H	28	10	1	X	Pyloroplasty	D	X	.....	...
26	May 1905	M	H	42	?	4	X	Gastro-Enterostomy	D	X	.....	...
27	Sept. 1905	M	H	43	14	2	O	.....	D	X	Died of broncho-pneumonia after ten days in hospital	...
28	Nov. 1905	M	H	54	28	5	O	.....	D	X	.....	...
29	Jan. 1906	M	H	22	28	3	X	Gastro-Enterostomy	D	X	..... Child lost sight of within six months	(13½)
30	Feb. 1906	M	H	92	?	1	O	.....	Rec.	...	Parents were tramps.	...
31	April 1906	M	H	49	14	4	X	Gastro-Enterostomy	D	X	Was collapsed on admission and never recovered	...
32	May 1906	M	H	31	?	7	O	.....	D	X	.....	...
33	May 1906	M	H	34	25	5	O	.....	D	X	Now well-grown, full of life. Used to have "liver attacks," Not now	12½
34	July 1906	F	P	14	12	3	X	Loreta	Rec.	...	Now a fine, big, healthy boy. No indigestion, occasional headaches	12
35	Mar. 1907	M	H	84	25	3	O	.....	Rec.	...	Congenital heart-disease. Very cyanotic. Well nourished	11½
36	May 1907	F	H	21	11	6	O	.....	Rec.	...	Now a healthy schoolgirl. Very athletic. No indigestion	11½
37	June 1907	F	P	75	26	?	O	.....	Rec.	...	.....	...
38	July 1907	M	H	48	none	4	X	Loreta	D	X	.....	...
39	July 1907	M	H	49	32	1	X	"	D	X	.....	...
40	July 1907	M	H	25	18	1	X	"	D	X	.....	...
41	July 1907	M	H	70	40	1	O	.....	Rec.	...	Did well for seven months, then parents went to Australia	(11½)
42	Dec. 1907	M	H	66	14	5	O	.....	D	O	.....	...
43	Jan. 1908	M	P	19	14	1	X	"	Rec.	...	Now strong, though thin. No indigestion. Enlarged cervical gland	11

Table of 100 Cases of Congenital Hypertrophy of the Pylorus (continued).

Number of Case.	Date First Seen.	Sex.	Hospital or Private Patient.	Age in Days When First Seen.	Age in Days at Onset of Forcible Vomiting.	Order of Child in Family.	If Operated on.	Nature of Operation.	Recovery or Death.	If Examined P.M.	Remarks.	Age in Years in Feb. 1919.
44	Feb. 1908	M	P	65	14	2	O	.....	Rec.	..	Now a very well nourished healthy schoolboy	11
45	April 1908	M	P	90	21	3	O	.....	Rec.	..	Now a big, strong healthy-looking boy	11
46	May 1908	M	P	112	21	2	O	.....	Rec.	..	Achondroplastic. Died of hydrocephalus a year later	..
47	Aug. 1908	M	P	21	12	1	X	Loreta and Gastro-Enterostomy	Rec.	..	Recurrent vomiting for about three years. Now strong and healthy	10½
48	Oct. 1908	M	H	56	40	2	O	.....	Rec.	..	Was quite well four years ago when parents went abroad	8½
49	Aug. 1909	M	H	31	?	1	O	.....	D	X	Diarrhoea	..
50	Sept. 1909	F	H	77	42	1	O	.....	D	O	.....	..
51	Jan. 1910	M	H	56	35	5	O	.....	D	X	.....	..
52	Feb. 1910	M	H	63	42	1	O	.....	D	X	.....	..
53	April 1910	M	P	54	12	1	O	.....	Rec.	..	Now a healthy boy with no dyspepsia	9
54	July 1910	M	H	56	53	5	O	.....	D	O	Died from infective diarrhoea	..
55	Oct. 1910	F	P	26	21	1	O	.....	Rec.	..	Now a big, fat, healthy child.	8½
56	Oct. 1910	M	H	59	31	4	O	.....	D	X	Occasional flatulence	..
57	Oct. 1910	F	H	30	?	1	O	.....	D	X	Died from infective diarrhoea	..
58	April 1911	M	H	24	11	2	O	.....	D	X	.....	..
59	May 1911	F	H	120	21	10	O	.....	D	X	.....	..
60	May 1911	M	H	30	18	1	O	.....	Rec.	X	Died from infective diarrhoea two months after vomiting had ceased	..
61	May 1911	M	H	89	32	3	X	Gastro-Enterostomy	D	O	.....	..

Congenital Hypertrophy on the Pylorus

62	July 1911	M	H	59	? 8	1	O	.....		D	X	Died from infective diarrhoea two months after admission Now a very healthy boy in every respect	7½
63	Nov. 1911	M	H	21	10	2	X	Loreia	.....	Rec.	...	Now in excellent health, occasional flatulence	7
64	April 1912	M	P	92	30	3	O		.....	Rec.	O	.....	6¾
65	May 1912	F	H	54	10	2	O		.....	D	...	Now in good health. Occasional slight indigestion and hiccough	6¾
66	May 1912	M	P	31	10	1	O		.....	Rec.	...	Now very healthy. A hearty eater	(7½)
67	June 1912	M	H	61	14	2	X	Loreia	.....	Rec.	...	Very strong and healthy at five years. Since lost sight of	6½
68	July 1912	M	P	295	10	2	O		.....	Rec.	...	Now well nourished. Slight eczema and recurrent bronchitis	6
69	July 1912	M	P	42	35	2	O		.....	Rec.	...	Now health is excellent. No indigestion	5½
70	April 1913	F	H	84	? 7	1	O		.....	Rec.	X	Now is very strong and well	...
71	Sept. 1913	M	H	28	7	2	O		.....	D	...	.....	...
72	Dec. 1913	M	P	82	20	5	O		.....	Rec.	X	.....	...
73	Feb. 1914	M	H	34	15	1	O		.....	D	O	.....	...
74	Mar. 1914	M	H	35	? 1	1	O		.....	D	X	.....	...
75	April 1914	M	H	42	? 2	? 2	X	Loreia	.....	D	X	.....	...
76	June 1914	M	H	49	? 3	? 3	X	Gastro-Enterostomy	.....	D	X	.....	...
77	June 1914	M	H	41	? 4	? 4	O		.....	Rec.	...	Did very well ; but died twelve months later from tuberculous meningitis	...
78	Nov. 1914	M	P	85	41	1	O		.....	Rec.	...	Wretched home. Large family. Rickety and poorly nourished like the other children	4
79	Mar. 1915	M	H	59	38	6	O		.....	Rec.	...	No illness since infancy. Very strong and well	4
80	Mar. 1915	M	P	85	21	1	O		.....	Rec.	...	Now a strong, healthy boy	4
81	Mar. 1915	M	P	32	22	1	X	Loreia	.....	Rec.	...	Now splendidly healthy. Occasional slight "bilious attacks"	4
82	Mar. 1915	M	P	62	28	1	O		.....	Rec.	...	Now a strong, fat, healthy child	3½
83	April 1915	M	P	26	never	1	O		.....	Rec.	...	.....	...
84	June 1915	M	P	33	27	2	O		.....	D	...	.....	...
85	June 1915	M	P	41	14	1	O		.....	D	O	.....	...

Table of 100 Cases of Congenital Hypertrophy of the Pylorus (continued).

Number of Case.	Date First Seen.	Sex.	Hospital or Private Patient.	Age in Days When First Seen.	Age in Days at Onset of Forcible Vomiting.	Order of Child in Family.	If Operated on.	Nature of Operation.	Recovery or Death.	If Examined P.M.	Remarks.	Age in Years in Feb. 1919.
86	Nov. 1915	M	H	27	22	1 twin	X	Loreta	D	O	.....	...
87	Nov. 1915	M	H	24	never	1	X	"	D	X	.....	...
88	Mar. 1916	M	P	49	37	3	X	Rammstedt	Rec.	...	Now a big, fat child, and well in every way	3
89	May 1916	M	H	43	14	7	X	"	D	O	.....	...
90	July 1916	F	P	84	15	3	X	"	Rec.	...	"Spendidly well," but will not take solid food	2½
91	Sept. 1916	M	H	24	7	1	O	.....	D	O	.....	...
92	Oct. 1916	M	H	49	21	9	O	.....	D	X	.....	...
93	Oct. 1916	M	H	84	42	2	O	.....	D	X	.....	...
94	Feb. 1917	F	H	135	21	1	O	.....	D	O	.....	...
95	Mar. 1917	M	H	46	28	2	X	Rammstedt	Rec.	...	Admitted in state of collapse and died in a few hours	2
96	Sept. 1917	M	H	59	35	7	O	.....	D	X	Now is a "splendid boy"	...
97	Oct. 1917	M	H	70	42	2	X	Rammstedt	Rec.	...	Found on admission to have acute hæmorrhagic nephritis	1½
98	Nov. 1917	M	P	70	?	5	O	.....	Rec.	...	Now "the finest specimen of his age in the district"	1½
99	May 1918	M	P	28	10	3	O	.....	Rec.	...	Now a robust baby. The digestion perfectly good	3
100	June 1918	M	P	84	14	2	O	.....	D	O	Now strong and well in every way In a state of collapse when first seen	...

SOME COMMENTS ON MEDICAL EDUCATION, LEGISLATION AND PRACTICE IN THE UNITED STATES.*

By NORMAN WALKER, LL.D., M.D., F.R.C.P., Direct Representative
for Scotland on the General Medical Council.

IN the summer of 1919 the National Board of Medical Examiners of the United States sent two of its members, Colonel La Garde and Dr Walter L. Bierring to Europe, to enquire into European methods of medical examination and registration, especially in the countries of the Allies.

After hearing their report the Board decided to invite representatives from Great Britain and France to make a similar visit to America.

The invitation was addressed to the Conjoint Boards of England and Scotland and to the University of Paris, and Sir Humphry Rolleston, Mr H. J. Waring and myself were selected from Great Britain, and Professors Roussy and Desmarest for France.

My difficulty is not that of finding matter for an hour's address, but to compress within its limits even a fraction of what I should like to say about Medical Education and Practice in America and its lessons for us.

I can only aim at accomplishing my object to-day by the strictest compression and by restricting myself rigidly to the important heads.

The British guests of the National Board of Medical Examiners of the United States of America left London on the morning of 10th April and sailed from Liverpool on the *Kaiserin Auguste Victoria* that afternoon.

After a pleasant voyage we reached New York on the afternoon of 19th April, and were met by Dr Walter L. Bierring, Secretary of the National Board of Medical Examiners.

He came provided with authority from Mr M'Adoo of the United States Treasury, and our passage through the Customs was easy. We entered on the social side of our work almost immediately, for, after a very brief time to change, we dined at the Metropolitan Club with a group of New York's leading

* Being the substance of two Addresses delivered to the Royal Colleges of Edinburgh and the Royal Faculty of Physicians and Surgeons of Glasgow.

Norman Walker

medical men. Dr Austin Flint was the host, and there were present among others, Professors Hermann M. Biggs, George B. Stewart, George E. Brewer, Walter B. James, Alexander Lambert (Retiring President, A.M.A.), and Dr R. C. Powell, Registrar, Dominion Medical Council of Canada.

We were not asked on this occasion to say what we thought of America.

Next morning we left for Washington, where we arrived in the afternoon, and met at dinner the three Surgeons-General of the United States, General Ireland (Army), Admiral Braisted (Navy), and General Cumming (Public Health Service). These gentlemen are all ex-officio members of the Board, and Admiral Braisted is its Chairman. Each of them nominates an Assessor to the Board from his branch of the Service and these gentlemen were also present.

It is at first a little difficult for us to grasp the remarkable difference in the relations between the officials of the Services and the civilian profession in our respective countries. Admiral Braisted is not only the Chairman of this predominantly voluntary body, but he holds this year the position of President of the American Medical Association, a body closely corresponding to the British Medical Association, and he delivered a Presidential Address, admirable in spirit, if a trifle long, which dealt with the future of medicine with a freedom which we should not expect from one of our Directors-General.

On the following morning we were introduced by Admiral Grayson (the President's physician) to the Secretary of State, Mr Colby, and the Secretaries of the Army and the Navy, Mr Baker and Mr Daniels, who received us very cordially and displayed an intelligent interest in our mission. The rest of the day was spent in visiting the training schools and hospitals of the three Services, all of them admirably equipped.

In the evening we embarked on our long railway journey to New Orleans, where we arrived about noon on the second day. The object of our visit to this town, where we spent a week, was to make us known to large bodies of American medical men, for it had been chosen as the centre, for 1920, of the meeting place of many Associations.

We found the Association of American Military Surgeons in session, attended their meetings, which dealt with an abundant variety of topics, and were honoured by election as Honorary Members. On the Tuesday of the following week began

Medical Education, etc., in the United States

the meetings of the American Medical Association whose business is conducted very much on the lines of the British Medical Association Annual Meeting, except that the sections meet regularly both forenoon and afternoon, and sometimes for a third session at eight o'clock at night. Nearly four thousand members registered, and we met many old friends and made more new ones. Each of us in the section in which he was specially interested received the warmest possible reception. There is no trace of weakening of the Allied bonds—medically. During the week we visited the University and Medical College of Tulane, as the local University is named after a pious founder.

Most of you are aware that thirty years ago American medical degrees were looked upon in our country with something short of respect. Many of the Schools were even then excellent, but they were undoubtedly prejudiced in our minds by those which were not. Charters of Incorporation were easily procured, and some of the Schools were simply proprietary concerns. Others, however, though they may not have reached our old established standards, were wonderfully good, practical Schools, and they certainly filled a much needed want in so rapidly expanding a country.

Although the rate was greatly accelerated by the Flexnor Report, the process of evolution had begun some years before, and now by an admirable co-operation between many bodies—I suppose, though I do not know, that it would be too much to say, all—concerned, the Medical Schools of America are all inspected and classified and distinguished by the letters A, B, C. For practical purposes, only Classes A and B need be considered. Class A numbers at present seventy-two Schools, a number that will probably be reduced when the current survey is complete; at one time or another there have been four hundred and thirty-nine Medical Schools in the States.

This classification is the work of the Council on Medical Education of the American Medical Association, and very notable have been its results. The American Medical Association is, like our British Medical Association, an entirely voluntary body but it has behind it in this matter the weight of the entire medical profession. The readiness with which the Medical Schools submit to the inspection of this voluntary body is illustrative of the generally cordial spirit of co-operation for the public good of which we came across instance after instance

Norman Walker

during our journey. The following are among the essentials of an Acceptable Medical College :—

1. A certain standard of preliminary education, which is referred to as a four year High School course. A High School in America is roughly similar to one of our Secondary Schools.
2. On the top of this, the applicant must have at least two years of a premedical College course, which *must include* Chemistry, Physics, Biology, and a modern foreign language (French or German).

(These words must be read literally, they do not mean that two years are to be devoted to these subjects. History, Rhetoric, Philosophy and English are often included, while one University we visited recommended drawing as one of its desired subjects.

Rush Medical College recommends that every student should complete a four years' College course if possible. "This additional College work should secure for him a greater breadth of culture and a catholicity of interest which will make him a man of larger power, influence and usefulness in the community.")

Of the 2656 graduates in Medicine in 1919, no fewer than 1180 held degrees in Arts or Science. This figure, equal to 44.4 per cent., compares remarkably with 15.3 per cent. in 1910.

3. The curriculum should be fully graded and should cover four sessions of at least thirty-two weeks each, exclusive of holidays. Two years should consist largely of laboratory work in well-equipped laboratories of Anatomy, Histology, Embryology, Physiology, Bio-Chemistry, Bacteriology, Pathology, Pharmacology, Therapeutics, and Clinical Diagnosis.
4. The College should provide at least eight expert, thoroughly trained professors in the laboratory branches, salaried, so that they may devote their entire time to instruction, and to that research without which they cannot well keep up with the rapid progress being made in their subjects. In Colleges having sixty students or less in each class, there should be at least one full-time salaried assistant in each of the departments of Anatomy, Physiology, Pathology, and Bacteriology, and Physiologic Chemistry, and Pharmacology. There should be an additional assistant for every additional thirty students.
5. The College should own or control a hospital in close proximity to the College, with not less than 200 beds, and a dispensary with an average daily attendance of 100 patients.

Medical Education, etc., in the United States

There are many other recommendations referring to museums, libraries, etc., and much stress is laid upon records, both those made by the student and by the teachers of the student's work all through his course. Such are, in brief, essentials of an Acceptable College, and Class A Colleges are those which are "acceptable."

In the course of our tour we visited in succession the following Medical Schools—Tulane University, New Orleans; Washington University, and University of St Louis, both situated in St Louis, Mo.; University of Iowa, in Iowa City; University of Minnesota, in Minneapolis, and the Mayo Clinic and Foundation in Rochester, which is the Graduate Medical School of the University of Minnesota. In Chicago we visited the University of Chicago, with which the well-known Rush College is affiliated; also the University of Illinois and the North Western University; the University of Cincinnati; the Western Reserve University of Cleveland, and the University of Michigan at Ann Arbor. At Detroit we paid an appropriately hurried visit to the Ford Motor Works. After a pleasant and interesting day at Niagara where, in addition to the Falls, we were shown over the Shredded Wheat Factory, we visited the Harvard Medical School at Boston and then went on to New York, where we visited the Medical Schools of three Universities, New York University and Bellevue, Columbia, and Cornell, as well as the Rockefeller Institute. From New York we went to Philadelphia where we visited officially the Medical School of the University of Pennsylvania, which claims a direct descent from Edinburgh and carries the Scottish thistle in its Coat of Arms, and unofficially the only Class A Homeopathic School in the States—The Hahnemann Medical College of Philadelphia. My colleagues, who outstayed me by a week, visited the Jefferson College of Philadelphia and the Johns Hopkins Medical School in Baltimore. The selection of Schools was carefully made so that we might see different types of the Class A Schools. Some are known by repute to everyone, others were selected for special reasons, in particular those of Iowa, Ann Arbor, and Minneapolis, which are under the care of their respective States, and that of Cincinnati, which is controlled by the City.

The conditions regulating the practice of medicine in America differ very widely from those here. In this country the Medical Act of 1858 established a Council of Medical Education and Registration for the United Kingdom of Great Britain and

Norman Walker

Ireland, which defines the conditions of admission to the *Medical Register*, an annual publication which enables the public to distinguish between qualified and unqualified practitioners; in America each State is in this matter a law to itself and each of the forty-eight States of the Union has an Act for regulating the practice of medicine within its boundaries. Some of these laws are good, some are really very good, some are far from good, and it by no means follows that the best laws are found in the oldest established States. All of them, I think I am correct in saying, aim at restricting the practice of medicine to those whom they regard as qualified. The qualification is not, as with us, attained by passing the examination for a university degree or a College licence. However severe the standard of that has been, everyone who proposes to practise in any given State must appear before a State Board. It will be noticed that I use the indefinite and not the definite article; some States have as many as three Boards—Regular, Homœopathic, and Eclectic, relics of days now happily passing when these distinctions counted for much. The Boards are composed of from five to nine members and are nominated by the Governor of the State. When some people mention this to you they scowl and say in a bitter tone—"Politics, Ha! Ha!" I was not impressed by this. I think some of the laws are very unfortunate in the conditions they lay down, *e.g.*, in one very famous State of the Union, where the Board consists of seven members, it is stipulated that not more than four of these may belong to any one School of Medicine, and so only four regular practitioners sit on that Board. But this is the fault of the law and not of the Governor, and the weakness is not inherent in the nomination system. I suppose there is no body of men whose repute stands higher than that of British Judges and yet their appointments are almost always political. It is much more unfortunate that most, if not all, the laws specify that no members of the Board must be connected with any teaching school and so the chief source of supply of really competent examiners is cut off. The examination is on paper, and very often in practice something of an ordeal. I doubt whether even one of our honours graduates would approach with confidence a week after his graduation an examination which included Anatomy, Physiology, Pathology, Materia Medica, Medicine, Surgery, Obstetrics, Medical Jurisprudence, and Public Health, while to one who has been say ten years in practice it

Medical Education, etc., in the United States

must be a perfect purgatory—or worse. Some of the States admit anyone to the examination even if he does not possess a medical degree, others accept any medical degree, even from a College of Osteopathy, others lay down conditions more severe than any of our requirements. Thus the States of Pennsylvania and of New Jersey, Alaska Territory, N. Dakota, Michigan, Rhode Island, Washington, D.C., Illinois, and Iowa, require graduation from a Class A School, the essentials for which I have already explained, and evidence of having acted for one year as interne in an hospital. If the full letter of the law were insisted upon it is evident that most men would be tied for life to the State for whose examination they had sat when they were young and fresh off the irons. Fortunately common sense has prevailed and many of the States have established reciprocity with each other. In 1919, 2458 medical men were registered by reciprocity. Some important States maintain that reciprocity is immoral, inasmuch as the duty is laid on the State Medical Board to satisfy *itself* that the applicant has a sufficient knowledge of Medicine to warrant them in licensing him. But even these have some bowels of mercy, and temper the extent of the examination to those whose graduation is many years behind them. I was assured that in several States at least I should be accepted—without any examination.

To-day most of the Boards concern themselves much more closely with the education of the medical man than their not very distant predecessors. Graduates of Class C Schools are admitted to the examinations of eight or nine States only, and it is interesting and encouraging to know that recognition of these is often denied by their home State Board which presumably knows them best. Graduates of B Schools are recognised by from ten to seventeen Boards, the top figure being that of the College of Evangelists. Class A School graduates are admitted to almost all State Boards' examinations except that of Pennsylvania—due to requirement of one year's internship.

I have dealt thus fully with this matter, for an understanding of the conditions under which they work is essential to the understanding of the position of the National Board of Medical Examiners of the United States of North America, under whose auspices our visit was made.

I am loath to weary you with details, but I am very anxious to make plain in this country the special difficulties of the

Norman Walker

Medical Reformer in America owing to the existence of forty-eight States, a district, and a territory, each with its own Medical Act, I have here a list of the conditions in each of these—hardly two are alike. I shall only submit a brief abstract.

ALABAMA.—The State Board is the Board of Censors of the Medical Association of the State, and consists of ten members (physicians). College Standard: Two years of work in an approved College of Liberal Arts, including courses in Physics, Chemistry, Biology, and a foreign language, prior to entering on the study of medicine. This is the requirement for all Class A Schools, and is noted under other States in College Standard = 2 years.

ALASKA.—State Board—Eight members appointed by the Governor, two from each judicial division. College Standard = 2 years. Applicants must also produce evidence of the completion of a year's internship in a recognised hospital, or of four years' active practice.

ARIZONA.—State Board—Five members: two regulars, one homœopath, one eclectic, and one osteopath, appointed by the Governor. College Standard: For physicians = 2 years, for osteopaths and practitioners of "other systems," graduation from a "legally chartered" College. No licence is granted to anyone whose preliminary education is less than that required to receive a High School diploma in the State.

ARKANSAS.—Three State Boards—Regular, Homœopathic, and Eclectic, each consisting of seven members appointed by the Governor of the State. College Standard = 2 years.

CALIFORNIA.—State Board—Ten members, appointed by Governor. College Standard: Evidence of graduation from a California four-year High School or its equivalent, and of a year of work of College grade in each of the subjects of Chemistry, Physics, and Biology.

COLORADO.—State Board—Nine members appointed by Governor. College Standard = 2 years.

CONNECTICUT.—Three State Boards—Regular, Homœopathic, and Eclectic, five members on each. College Standard = 1 year.

DELAWARE.—Two State Boards—Regular and Homœopathic, each five members. College Standard: The minimum standard of preliminary education is a certificate of admission to the Latin-Scientific Course of Delaware College.

DISTRICT OF COLUMBIA (surrounding Washington).—Three Boards—Regular, Homœopathic, and Eclectic, each five members, appointed by the District Commissioners. The Presidents of these three

Medical Education, etc., in the United States

Boards with two persons, not physicians, one of whom must be learned in the law, constitute the Board of Medical Supervisors, who exercise a general control over the Boards. College Standard: Only requirement is that the candidate's diploma must represent a four-years' course of study in a College authorised by law to confer the degree of Doctor of Medicine.

FLORIDA.—Three State Boards — Regular with seven members. Homœopathic with three, Eclectic with three. College Standard none. The Regular Board recognises only diplomas granted by Class A Schools.

GEORGIA.—State Board—Ten members five regulars: three eclectic, two homœopaths. College Standard = 2 years.

IDAHO.—The Medical Acts are administered by a (lay) Commissioner of the Department of Law Enforcement. College Standard: Only Class A and Class B Schools are recognised.

ILLINOIS.—The place of a State Board is taken by the Department of Registration and Education, consisting of a director, an assistant-director, and a superintendent of registration, none of them physicians; the same department deals with other registered professions and trades. The Committee of Examiners consists of five reputable licensed physicians. College Standard: All matriculants after October 1918 must take a six years' course: two of these years may be taken at a College of Liberal Arts. All who graduate after 1st July 1922 must have completed a year's internship in an approved hospital.

INDIANA.—State Board—Six members appointed by the Governor: two regulars, one homœopath, one physiomedicist, one eclectic, and one osteopath. The examination in *Materia Medica* is not required of osteopathic or other practitioners not employing drugs as a therapeutic agent, but they must pass in all the other subjects. College Standard: One year in a College of Liberal Arts, and the equivalent of one half of the credits necessary to obtain the degree of B.S. (B.Sc.).

IOWA.—The physicians of the State Board of Health constitute the Licensing Board. They number five and are appointed by the Governor. College Standard = 2 years.

KANSAS.—State Board—Seven members appointed by the Governor. College Standard = 1 year.

KENTUCKY.—State Board—Eight members, seven appointed by the Governor, one co-opted by the Board. Five are regulars, one is a homœopath, one an eclectic, and one an osteopath. College Standard = 2 years. *Kentucky requires, in addition to other conditions, that a medical school should have among the subjects taught, medical*

Norman Walker

book-keeping and the other essentials in the business life of a physician, and his duties to the poor, and a course in medical ethics and medical organisation.

LOUISIANA.—There are two State Boards of five members each appointed by the Governor, one homœopathic, and one recommended by the Louisiana State Medical Society, which deals with all other kinds of practitioners. College Standard = 1 year. Only graduates of A and B Colleges are admitted to the State Examination. Christian Scientists are not prohibited provided they “rely on faith and prayer alone.”

MAINE.—State Board—Six members appointed by the Governor. College Standard: One year; only graduates of A and B Colleges admitted to examination.

MARYLAND.—Two Boards—One Regular, one Homœopathic, eight members each. The former is appointed by and represents the Medical and Chirurgical Faculty, the latter the State Homœopathic Medical Society. College Standard = 2 years.

MASSACHUSETTS.—Board consists of seven members; not more than three shall at one time be members of any one chartered State Medical Society. College Standard: Applicants must be graduates of legally chartered Medical Schools.

MICHIGAN.—Board consists of ten members: five regulars, two homœopaths, two eclectics, and one physiomedical. College Standard = 2 years. The Board lays down a full detailed curriculum stating the minimum number of hours of instruction required in every subject. All applicants who matriculated in 1917-18 and thereafter must have spent a year's internship in a recognised hospital.

MINNESOTA.—Board consists of nine members appointed by the Governor; three of them are homœopaths. College Standard = 2 years.

MISSISSIPPI.—The State Board of Health supervises the licensing of physicians. Eight members are appointed by the Governor, and five by the State Medical Association. College Standard = 2 years: Only graduates of A Colleges are recognised.

MISSOURI.—Board consists of seven members appointed by the Governor, and “at least five of said Board shall be physicians in good standing and of recognised professional and scientific knowledge, and graduates of reputable schools”! College Standard: graduation from an accredited High School.

MONTANA.—Board consists of seven members, one appointed annually by the Governor. College Standard: Applicants must be graduates of Class A Schools, which involves two years of premedical

Medical Education, etc., in the United States

study, and applicants from foreign schools graduating since April 1916 must attend at least one full course of study in a Class A School.

NEBRASKA.—The State Department of Health consists of the Governor, the Attorney-General, and the Superintendent of Public Instruction. There is an Advisory Board of Medical Examiners with two regular, one homœopathic, and one eclectic member. College Standard: Only graduates of A and B Schools are recognised.

NEVADA.—Board composed of three regulars, one homœopath, and one eclectic. College Standard: The Board recognises Colleges legally organised in the State or Territory in which they are located.

NEW HAMPSHIRE.—Board consists of five members appointed by the Governor. College Standard = 2 years or equivalent.

NEW JERSEY.—Board composed of five regulars, three homœopaths, one eclectic, and one osteopath. College Standard = 2 years.

NEW MEXICO.—Board consists of 7 members appointed by the Governor. College Standard = 2 years.

NEW YORK.—The Board consists of nine members appointed by the Regents of the University of the State of New York. The Board submits lists of examination questions from which the Regents select. College Standard = 2 years.

NORTH CAROLINA.—Board consists of seven members appointed by the State Medical Society. Only graduates of Class A Schools are admitted to the State examination.

NORTH DAKOTA.—Governor appoints Board of nine members, two of them homœopaths. All the members must be graduates of Medical Schools of high educational requirements. College Standard = 2 years. Only graduates of A and B Schools are admitted, and evidence of a year's internship must be submitted.

OHIO.—The Governor, by and with the consent of the Senate, appoints a Board of seven members. College Standard: The Board appoint a preliminary examiner, who passes on credentials or may require applicants to submit to a further high-class examination.

OKLAHOMA.—Governor appoints four regulars, two homœopaths, two eclectics, and one osteopath to the Board. College Standard = 2 years.

OREGON.—Governor appoints three regulars, one homœopath, one eclectic, and one osteopath to form the Board. College Standard: Graduates of any lawfully organised College that now requires four years of instruction of eight months each.

PENNSYLVANIA.—The Bureau of Medical Education and Licensure

Norman Walker

of the Department of Public Instruction of Pennsylvania consists of seven members. Two of these are *ex-officio* the Superintendent of Public Instruction and the Commissioner of Health; the other five are legally qualified physicians appointed by the Governor; one must be a regular, one a homœopath, one an eclectic; the other two are not to represent the same school of medicine. College Standard: One year and evidence of a year's internship is required from candidates for the State licence.

RHODE ISLAND.—Board of seven members: six regulars and one homœopath appointed by the Governor. College Standard = 2 years. Evidence of a year's internship required.

SOUTH CAROLINA.—Board of eight members, nominated by the State Medical Association and appointed and commissioned by the Governor. College Standard: Since 1st July 1917, only diplomates of Class A Schools are accepted.

SOUTH DAKOTA.—The Board of Health and Medical Examiners consists of five members, one a homœopath. College Standard = 2 years.

TENNESSEE.—Board of six members: four regulars, one homœopath, one eclectic. College Standard: Applicants must be graduates of schools whose curriculum is as high as that at present enforced in the University of Tennessee, which is Class A.

TEXAS.—Board consists of eleven members: no school of medicine is to have a majority on the Board. College Standard: The Board only admits graduates of *bona-fide* reputable Medical Schools. Evidence of a year's internship required.

UTAH.—Board of ten members, nine appointed by the Governor from various Schools of Medicine; the Attorney-General is the tenth. College Standard = 1 year.

VERMONT.—Board of seven members: three regulars, two homœopaths, two eclectics, appointed by the Governor from lists submitted by the Medical Societies of the State. College Standard = 2 years. The Board have intimated that they will impose a requirement of one year's internship as soon as they deem it expedient.

VIRGINIA.—Board: one regular physician from each congressional district (10), and a homœopath and an eclectic from the State at large. College Standard = 2 years.

WASHINGTON.—Board of nine members, two of them homœopaths. College Standard = 2 years. A year's internship required.

WEST VIRGINIA.—The Public Health Council consists of the Commissioner of Health and six other members nominated by the Governor, by and with the consent of the Senate. College Standard =

Medical Education, etc., in the United States

1 year. Applicants must be graduates of A or B Class Schools. The Board has ceased to reciprocate with States which recognise graduates of Class C.

WISCONSIN.—Board consists of eight members (three regulars, two homœopaths, two eclectics, and one osteopath) selected by the Governor from lists of ten names submitted by each of the Medical Societies. College Standard = 2 years.

WYOMING.—Board consists of five members appointed by the Governor. College Standard: Recognition by Examining Boards of the State in which the College from which the applicant graduates is located.

To us the Sectarian College is entirely strange. Enlightened American educationalists regard them with a sort of contemptuous pity, and nothing is further from their minds than making martyrs of them. There is no need to do so. Of the total number of medical students in 1919, 13,052, 93.9 per cent., are in attendance at regular schools, 3 per cent. at homœopathic, 0.7 per cent. at eclectic, and 2.4 per cent. at nondescript colleges, semi-osteopathic, etc.

More than one of the States makes provision for the curious class of drugless practitioners. They must pass an examination in Anatomy, Physiology, General Diagnosis, Pathology and Elementary Bacteriology, Obstetrics, and Gynæcology, Toxicology and Elementary Chemistry, Hygiene and Sanitation, and must obtain in the examination a general average of 75 per cent.

The use by the holder of a "drugless practitioners' certificate" of drugs, or what are known as medicinal preparations, or the performing of any surgical operation, etc., is grounds for the revocation of his licence.

There are obviously in these methods many inconveniences, and these have long been recognised in the States.

After some years of preliminary discussion a very important step forward was taken in the founding in 1915 of the National Board of Medical Examiners. So convinced are those in office to-day that it is to the persistent and persevering efforts of one man that the step is due that they have ordered that all their documents shall contain under the title the words, "Founded by Dr W. L. Rodman." Dr Rodman lived long enough to see his child through the first perils of infancy, and the Board has appointed his son, Dr J. S. Rodman, as Secretary in his father's place.

Norman Walker

CONSTITUTION OF THE BOARD.—The Americans are, like ourselves, a practical people: the founders of the National Board recognised that if they waited for Federal Legislation they might wait till this century was in its dotage or its grave; and they decided to make bold, to go ahead, to show that the thing was feasible, and so to make the path of legislation easier.

The relations between Government Departments and the profession generally are closer in America than they are with us. It would not, I think, occur to many here in planning a voluntary unofficial Board of this sort to go to the Navy, the Army, and the Ministry of Health and ask for the services of the Medical Directors of each of these Services. But that is what they did in America, and not only that, but they placed in the Chair (an admirable selection by the way) the Surgeon-General of the Navy, Admiral W. C. Braisted. He and his two colleagues each nominate an assessor, an officer from their Service, and in this way Colonel Russell (Pathology), Admiral Stitt (Bacteriology), and Colonel Rucker (Hygiene), are members and examiners for the Board in their respective subjects. Next, to ensure the friendly co-operation of the State Boards, three members are chosen from the federation of these bodies: Dr Strickler, the President (Colorado), Dr W. L. Bierring (Iowa), Secretary Editor of the Federation, Examiner Pharmacology and Medicine, and Dr Harlan (Maryland). Nine co-opted members, in American phraseology "members at large," complete the Board. These are carefully chosen from all over the States to provide capable examiners in all the required subjects. Their names are almost all known everywhere as authorities on their subject:—Dr Victor C. Vaughan, Dean of the Medical Faculty of Ann Arbor (Biological Chemistry); Dr E. Wyllis Andrews of Chicago, Professor, North-Western University Medical School (Surgery); Dr Louis B. Wilson of the Mayo Clinic (Pathology); Dr Isadore Dyer,* Dean of Tulane University, New Orleans (Dermatology); Dr Horace P. Arnold, Chairman of the American Medical Association Council on Medical Education, formerly Dean of the Graduate School of Harvard (Medicine); Dr Austin Flint of New York, Professor, Bellevue Hospital Medical School (Obstetrics and Gynæcology); Dr W. S. Carter, Professor of Physiology, State University of Texas, Galveston, Texas (Physiology).

* While this address was in the press, I learned with great regret of Dr Dyer's death.

Medical Education, etc., in the United States

The Board has recently co-opted two non-medical members, Mr H. S. Pritchett, President of the Carnegie Foundation for the Advancement of Teaching, and Mr J. C. Bowman, who recently resigned the Presidency of Iowa University to become Director of the American College of Surgeons.

This Board set itself to devise and set agoing an examination of such a standard as would warrant any State Board in accepting it in substitution for its own. They laid down very stringent conditions for admission to the examination; they fixed a high standard for a pass and they have got through their early difficulties so successfully that already twenty States have agreed to accept their certificate, while several others have indicated that they will do so when certain technical formalities in their State Laws, which only legislation can enable them to dispense with, are set aside. Further, with the addition of a special examination in Hygiene and Physics candidates otherwise suitable are admitted to the Government Services.

The examination comprises—Anatomy, Physiology, Bio-Chemistry, Pathology and Bacteriology, Pharmacology and Therapeutics, Medicine (Neurology, including Psychiatry, Diseases of Children, Tropical Medicine, Medical Jurisprudence), Surgery (Operative Surgery in laboratory), Diseases of the Eye, Ear, Nose, and Throat, and Skin and Venereal Diseases, Obstetrics and Gynæcology, Hygiene and Sanitation, Epidemiology.

The over-all pass mark is 75—one mark below 50 or two below 65 involve rejection even if the total averages 75.

I had the good fortune of entering on this enquiry not altogether uninformed. Thirty years ago I had an opportunity of seeing a good deal of the Medical Schools of America, and in my Presidential Address to the Carlisle Medical Society* at the opening of the Session 1890-91, I gave some notes on my impressions. Reading these over after that lapse of time, I am astonished at the frankness of many of my criticisms—a little shocked, looking back with the maturer judgment of middle age upon the impertinence of youth, and agreeably surprised to find that in some of the criticisms I anticipated the famous report of Dr Flexner, made twenty years later.

It is really very interesting to contrast the two impressions and to reflect that one who was, I think, quite justified in saying that "the Schools of America are not established on the best

* *Edin. Med. Jour.* 1891, vol. 37; pp. 135 and 239.

Norman Walker

basis"—"the professor may happen to be a physician or surgeon to a hospital, but it is quite as likely that he is not"—"they endeavour to make all their lectures practical, and many of them succeed so thoroughly that only the reading men among the students can possibly follow them intelligently"—"the fact is that the want of a thorough grounding in Anatomy, Physiology, Pathology, and Therapeutics makes it impossible for a Lecturer in Medicine to deal so freely with his subject as he can when he can presume on his students' knowledge of these subjects and can go straight on without explaining the normal structure and functions of the affected organ with which he is dealing"—to-day, after a second and much more thorough study, has a difficulty in moderating the high opinion he has formed of the present position of Medical Education in America.

None of the Schools which were visited admit all and sundry; indeed I would almost say that it is more difficult to get into some of these Schools than it is to get out of them as a graduate. To save time, I will content myself with one illustration.

The University of Minnesota admits eighty entrants annually. It considers that that is the number which it is equipped for teaching adequately. The Dean of the Medical Faculty of that University told me that he had 400 enquiries from those who proposed to enter last Autumn. By a strict scrutiny of the educational qualifications of the applicants he reduced it to below 200.

Here I may interpose a reference to a future in American Medical Education the introduction of which would, I think, be a benefit in this country; indeed the general tendency in America to co-operation is a thing we might well imitate. The Dean of a School to whom application is made by a candidate writes to any of those who have been concerned with the candidate's earlier education and examination and receives, apparently, invariably an answer to all the enquiries he may make. I do not know whether an enquiry addressed to certain educational authorities in this country would always receive a prompt reply, saying that Mr A—— B—— had received sixty or eighty marks in a particular examination for which he had sat, and I feel more doubt whether the schedule which enquired into his personal appearance, his manner with associates, his initiative, ambition, industry, tact, use of oral English and use of written English, would receive so full a reply as it seems to do invariably in America. At

Medical Education, etc., in the United States

any rate, the Dean by this means reduced the numbers to something like 150. They then conducted a physical examination, and rejected those who were deficient. In this connection I may note in passing, as a matter of interest, that the medical students of the United States came out first in sorting out students for the Army drafts. But still this did not get down to eighty, and they then applied mental tests, and a series of examinations on the Binet method were applied to the residue. It is obvious that a class so carefully selected must prove excellent material to work upon. At the end of the first year unsuitable students are weeded out, and advised either to give up medicine or to find some other place to study it in, and their places are filled by students from Schools which have as yet no clinical facilities and only give the first and second year's instruction in medicine.

I think I am right in stating that the Freshman Class is much more often under 100 than over that figure. Harvard admits 125.

It might be thought this restriction of students which is applied, though not so strictly in all Universities, as in Minnesota and a few others, would have the effect of leading to a serious deficiency in the number of medical practitioners. This danger is not unappreciated; but it is the opinion of those who have studied the question that the communal interests are better served by two good doctors than by three indifferent ones.

Further, the Committee on Medical Education of the American Medical Association, to whose work I should like to pay a tribute of admiration, points out that the number of practitioners proportionate to the population is greater in America than in any other civilised country. The figures given in the Census Bureau in 1918 show that in America there is one physician for every 712 persons, while in Europe the proportion ranges from one in 1500 to one in 2500.

When with the essentials of a two years' College course, or a degree in Arts or Science as 44 per cent. of their entrants had in 1919, the student, if there is room for him, enters on his four years of medical education in a Class A School, he begins the subjects of Anatomy, Physiology, Bio-Chemistry and Bacteriology.

The laboratories are almost without exception admirably equipped, and each School admits no more students than it has ample accommodation for. The provision of material

Norman Walker

for the practical study of Anatomy naturally interested me specially, and the sight of the reserve supply in every School we visited made the mouth of an Inspector of Anatomy water. Perhaps the simile is not a very happy one. The Anatomy Acts of most of the States, for each has its own, are framed on ours, indeed the only important difference is in the substitution of "shall" for "may." But what a difference it makes. In America each student has allotted to him what is carefully described as the lateral half of a subject and all the students dissect the same part at the same time, to the great advantage of the teacher. An abundant supply of frozen sections enables the students to familiarise themselves with the relations of the parts. I must not dwell too long on this special concern of my own, but it was interesting to learn that since the introduction of Prohibition the supply had diminished by about 50 per cent.

In nearly all the Schools a great deal of attention is devoted to the Anatomy of the Nervous System, and in many Histology is taught separately by an Associate Professor of Anatomy.

Physiology and Bio-Chemistry are, I think, more often than not separate Chairs, with complete laboratory equipment, and the students who are, I think, more strictly regimented than ours, usually work three-hour periods at a time. They get in a little more time than we do, for classes run every day from 9 to 5 and on Saturday from 9 to 1. Here is the Physiology course of one, admittedly one of the best Schools—First year, first term: Organic Chemistry, three single hours weekly; second term: Biological Chemistry, laboratory four hours twice weekly, and one lecture; third term: three hours laboratory work twice weekly, with an extra hour on the one day of the six, on which there is no lecture. Second Year, first term: five one-hour lecture or recitation (experiments discussed) and two three-hour laboratory periods; second term: three one-hour lectures. These sum up a course of 607 hours, and ten teachers take part in the instruction of the thirty-seven first and twenty-two second year students.

In Physiology again the difference in the laws enables the American teacher to demonstrate physiological facts more fully to his students. Before I leave the subject of Physiology, I should like to mention one interesting fact. When I was in Philadelphia thirty years ago, Dr William Pepper, Provost of the University of Pennsylvania, showed me much kindness. He

Medical Education, etc., in the United States

was very proud of the direct descent of the University of Pennsylvania from Edinburgh, pointed out to me the thistle in its Coat of Arms and claimed—I am not sure rightly—that his title of Provost also marked the descent. This spring Dr William Pepper, his son, Dean of the Faculty of Medicine, told me that their University had taken another thing from Edinburgh, viz., the title of the Chair usually called Physiology, and designated theirs also the Institutes of Medicine. In more places than Philadelphia I thought I detected signs of a desire to get back to the spirit of that old term.

Bacteriology in Washington University begins in the third term of the first year, with three hours of laboratory work thrice weekly. In the next two terms pathology takes these laboratory hours and two lectures and two hours for post-mortem work, while in the next two, what are called Clinical Pathological Conferences, occupy one hour weekly. Seven teachers form the staff.

Pharmacology shares with Physiology in the advantages of more liberal Vivisection Laws. In some Schools the department is linked as closely as possible with that of Physiology. Not too much attention is paid to Materia Medica. In Rush Medical College, Materia Medica is linked with Chemistry.

As a rule the Freshman (1st) and Sophomore (2nd) years are devoted entirely to laboratory work, but in an increasing number of Schools there is evidence of an intention to break down the water-tight doors, and in the last term of his Sophomore year the student is introduced to clinical work by doing his bio-chemical and bacteriological work on patients.

One would think that after having carried for a year the resonant title of a Sophomore it was rather a come down to be called a Junior, but that and Senior are the designations of the third and fourth year student. These clinical years are as in the corresponding ones here very full. The lesser number of students and the large number of teachers (the teaching staff in Medicine in Washington University numbers twenty-five), permits of a different, I shall not say a better, method of teaching. After a period of introduction to methods, the student is put directly in touch with patients (in or out), and made to observe for himself. Later his instructor goes over the case with him and points out what he has missed.

In the Middle West Schools the importance of training in public health is emphasised, and the student in his junior year

Norman Walker

spends in the first half one forenoon a week in the Board of Health and in his second a whole day a week at the Tuberculosis Hospital.

In one of the Schools which we visited, I think Washington University, the Class of Operative Surgery was a special feature. The students were divided into sections of eight, not eighty as I was reported in *The Lancet* to have said, and the patient was a dog. One of the students represented the family doctor and he read a carefully prepared account of a case which seemed to indicate an operation. The pros and cons of this were discussed and when it was decided to operate, one of the students acted as anæsthetist, another as surgeon, another as assistant surgeon, and another as theatre sister. I cannot be sure whether he dressed for this part, but it is quite likely. Another acted as pathologist and took cultures and examined the blood. At the next session a week later progress was reported; if anything had gone wrong, the class resolved itself into a Committee of Enquiry; if death had occurred, into a coroner's jury, with one member acting as coroner. The same procedure was followed if the dog died under the anæsthetic.

The year of intern work which an increasing number of Schools and States now require, is of course of enormous value. When one has urged that here the reply usually is that the idea is excellent but impracticable. It has not been found so in America. There is a shortage rather than a surplus of applicants. Here is a paragraph from the Report of the Committee on Medical Education of the American Medical Association to the House of Delegates, 1919:—

“This shows the remarkable increase in the appreciation of and demand for interns. It shows also the utter impossibility of graduating a sufficient number of medical students to meet the demand, even if we should multiply by four the number of physicians now graduating annually from our Medical Schools. It shows the necessity of employing house physicians, or of providing special assistants, who will do much of the work heretofore devolving on the intern.”

No hospital is recognised as capable of giving the Certificate of Internship unless it reaches a prescribed standard.

I have repeatedly urged that the easiest way of lengthening the medical curriculum is to increase the time devoted to study in each year, and I was naturally interested to find that more than one of the American Schools were in practically continuous

Medical Education, etc., in the United States

session : each student having seven weeks' holiday in the year. Chicago has four terms and the student must keep three. It was interesting to see in print the statement that "the climate of Chicago is peculiarly well adapted to midsummer work." In Cleveland the first three years contain nine, the last eleven months of work. Of course this is only rendered possible by the large number of teachers.

I shall take the University of Minnesota as my text for some remarks on what is called "Graduate Instruction" as contrasted with "Post-Graduate," which term is arbitrarily limited to what we usually describe under that name, viz., a series of refresher courses for men who have been some years in practice.

Graduate instruction in America is a different thing. Its purpose is so admirably expressed in a paper by Dr Lyon, Dean of the Medical Faculty in Minnesota, that I can best explain it to you by quoting him verbatim :

"As I see it, the fundamental elements of the situation are expressed in six almost self-evident propositions :—

"Proposition 1.—The important facts of medical science have become too many for one man to know, and the necessary technical processes have become too complex and numerous for one man to master. Division of labour or specialism is advantageous and unavoidable. This is true alike for better practice and for surer progress.

"Proposition 2.—Systematic graduate training in the clinical specialities, including advanced work in the underlying sciences, is a necessity. This means co-operative and co-ordinated educational processes.

"It is true that the first specialists had to make both themselves and their speciality. It is true that many excellent men in every profession have been self-trained. Nevertheless, both economy of effort and the legitimate interest of the public demand that the education of specialists be systematised and standardised.

"Proposition 3.—The safeguarding of the public demands some method of certification for specialists. This is, perhaps, quite as important as the primary certification or licensure. How is the average citizen at the present time to proceed in order intelligently to select a competent surgeon? The answer is, 'It can't be done.' Perhaps as good a way as any is that of the Minneapolis lady who went into a big office building, stood in front of the directory of physicians, closed her eyes, said a little prayer, put out her hand, and had her appendix removed by the physician whose name her fingers thus blindly hit on.

Norman Walker

If she found a competent man, it was a miracle, or else a lucky chance; for in that directory the names of the experienced and the inexperienced, the highly trained and the self-announced, stand forth in type of equal size.

"Proposition 4.—The progress of medical science is of the utmost importance alike to individual human need, to civilisation as a progressive ideal, and to the profession of medicine as a satisfying life-work for men of the best intelligence.

"Proposition 5.—The leaders of medicine as exemplified by the class of specialists, should be more than practitioners. They should be scientists.

"Real success in practice demands scientific method and the scientific spirit. Leadership in the profession should rest on productive scholarship. The education of specialists should be planned with that end in view.

"Proposition 6.—The progress of medical science demands more and more rigid scientific preparation on the part of all physicians, but particularly on the part of investigators. Some one has said that the future great discoveries of physics will be made in the sixth decimal place. In a similar way, it seems to me, refinements of quantitative methods and a more comprehensive, intelligent, and exact use of statistics are likely to add most of the great new truths of medical science. Nothing is fully known until it can be expressed mathematically. All this implies more rigid training for the medical investigator of the future.

"Every one of my six propositions involves a task appropriate to a University. The practical questions arise as to the extent to which a given University may undertake these tasks for the medical specialties, and how to go about what is undertaken. At the University of Minnesota we are feeling our way in both these particulars, and some account of our experience will be more valuable than further theoretical disquisition.

"First, however, let me say that for years every good Medical School in the country has been doing graduate work in the clinical branches, and is doing it now. It is unsystematised and for the most part unrecognised; but nevertheless, in the clinics and laboratories, there are always young graduates, as voluntary assistants, whose chief purpose is to learn. Many of the best men on the faculty of Rush Medical College were undoubtedly thus trained. They were not formally instructed; there were no requirements of entrance, attendance or examination. No degrees marked the completion of their post-graduate education. Nevertheless the men worked in a University atmosphere. The equipment and libraries were at their disposal.

Medical Education, etc., in the United States

The critical guidance of the master was unconsciously exerted. These are not self-trained men in the sense that I have previously used that term. They are University products. What we have attempted to do at Minnesota is to systematise what was already going on in our University (as in others), and give it consciousness and individuality."

Having completed his undergraduate career and done at least a year as a Resident, the man or woman who proposes to qualify as an expert in any branch of medicine enters a Graduate School on a further three years' course. He selects, with the help of the Dean, a Minor subject which must be logically related to his Major, *e.g.*, Anatomy to Surgery. To his Minor subject he must devote at least one-sixth of his total work. To the Major, the subject in which he intends to specialise, he must devote two-thirds of the total work for the Degree. Not many get the Ph.D. which is the highest distinction in American Medical Schools; most have to be content with the less distinguished M.A. or M.S., Master of Arts or Science.

I am very glad of an opportunity of saying something about the Mayo Clinic. Like many others I was inclined to regard the Mayo Clinic as a glorified surgical home run on admirable commercial lines with conspicuous success. There is no denying the success, but the Mayo Clinic is very much more than a nursing home. Founded in a small town of about 6000 inhabitants, the Clinic has now grown, until there are in Rochester no fewer than 1300 beds, and a large staff of teachers.

Conscious that the success of the Clinic depended too much on their personality, the Brothers Mayo in 1915 entered into an arrangement with the University of Minnesota, for recognition of the Mayo foundation as a permanent organisation, and a body of six trustees was established to administer the 2,000,000 dollars which the Mayo Brothers provided.

I had an opportunity of discussing very frankly with Dr Will Mayo the whole of the arrangements, and I have his consent to mention some financial facts, which I think should disabuse the minds of some at least of those who have sneered at the money-making character of the foundation. It will surprise them to learn that the Clinic is financed, and very successfully financed, by the fees below 1000 dollars. No fee over that comes into the Clinic funds, but goes into a separate fund, which is devoted entirely to public purposes such as Red Cross, Exploring Work and Education other than Medical, which the Mayo Brothers think they have done their duty by in the 2,000,000 dollars

Norman Walker

which they have set aside for the Graduate School of the University of Minnesota. Probably many of you know the very business-like arrangement of assessing the fee due from patients at one-twelfth of his annual income; and when one reflects on the enormous incomes of many Americans, it is evident that the amount of money devoted to public utilities must be very large.

So far from being a mere surgical home, every department of medicine has its place in Rochester. There are medical, ophthalmological, gynæcological, dermatological, orthopædic, and ear and throat clinics.

Altogether there are in this little town, to ensure the thorough treatment of the patients in the 1300 beds, no fewer than thirty-nine experimental and research laboratories. During 1918, 49,083 patients were examined clinically and 17,034 surgical operations were performed. The fullest possible record of each of these cases is filed in the research department.

Between 100 to 200 graduate students are constantly at work there. Several of them as teaching Fellows, who are remunerated in the three years of their Fellowship respectively, 800, 750, and 1000 dollars a year.

With the exception of a small amount of teaching, they devote the whole of the remainder of their time, excepting a yearly vacation of *three weeks*, to graduate work leading to a degree. I have seen something of post-graduate work in other parts of America, at home, and on the Continent, and I have no hesitation in saying that the opportunities of the Mayo Clinic are surpassed nowhere. I should like to add to this my own experience of "Patet omnibus" character of the Mayo Clinic. I believe I am warranted in claiming to have taught more students Dermatology than any other English-speaking teacher, but I do not wish it to be supposed that they are so numerous as would appear from my experience in the train between Rochester and Chicago, where no fewer than three men came up and introduced themselves to me as old students. Each of them had been at the Mayo Clinic for periods of one week, one month, and three months. Two of them had gone without any notice, and they were all agreed that they could not possibly have received more courteous treatment than they have received. Anyone ready and anxious to work needs no further passport to the Mayo Clinic.

Some indication of the esteem in which the Mayo Clinic is

Medical Education, etc., in the United States

held by the younger men of America, may be shown by the fact that there were 1000 applications for Fellowships in January 1919, of whom forty-two were selected.

Another interesting fact is that of the eighty-six non-teaching Fellowships, sixty were surgical and only twelve medical.

In concluding my reference to the Mayo Clinic, it is only right that I should not ignore altogether the criticisms which have been launched upon it. I think there is substance in some of them. I think the organisation of medical service to the extent it has been carried out in Rochester, would be a public danger in the hands of unscrupulous persons. By them it would be run in the interests of pecuniary profit only, with serious discredit to the good name of the profession of Medicine. Run, as Rochester is, by the Mayo Brothers, these criticisms fall as lightly as would the bullets from a machine-gun against 10-inch armour plating.

STAFF.—Thirty years ago I said "One great fault in the American Schools is the fact that almost all the Chairs are honorary; and, while this is no great deterrent to men who hold the Clinical Chairs—for to them their Chairs are well worth the time they give to them—it has the very worst possible effect on the purely scientific subjects." To-day no College is ranked as acceptable unless it has eight professors salaried so that they may give their whole time to the work of teaching and research. It must be remembered in reference to the figure eight, that the pre-medical College course deals with the subjects of Chemistry, Physics, and Biology, and that these are not included among the eight. One may say, speaking generally, that the eight include Anatomy, Physiology, Pathology, Pharmacology, Bacteriology, and Bio-Chemistry, and it is not uncommon to have more than one professor of a subject.

The filling up of the others raises a question of very great interest, namely, the whole-time professor of the practical subjects. I quote from the *Bulletin* of Washington University: "In 1910 the Corporation of the University, appreciating the value of the service which a Medical School can give to a community, with the co-operation of the Medical Faculty, reorganised the School in all departments and appointed heads of departments and instructors in Anatomy, Physiology, Biology, Chemistry, Pathology, Preventive Medicine, Medicine,

Norman Walker

Surgery, and Pediatrics, who devote themselves to teaching and research, and associated with this staff clinical instructors chosen from the medical profession of St Louis." These changes were made with the aid of funds donated by philanthropic citizens from St Louis. These endowments have enabled the School of Medicine to place the clinical departments of Medicine, Surgery, and Pediatrics upon the full University basis, under the direction and control of men devoting all their time to University work.

It is not very easy to determine the value of this whole-time system. Widely different opinions are held upon it, and already modifications have been made or are suggested. In some schools the method is carried out in its entirety, and the professor devotes literally the whole of his time to teaching and research. His salary is in the neighbourhood of 10,000 to 15,000 dollars a year which, at the present rate of exchange, is £2500 to £3800. In other Universities the Clinical Professors are almost whole-time; that is to say, they devote by far the greater part of their time to their University duties but are not inhibited from doing some private practice. American methods lend themselves to this more than ours do.

The system of Pay Wards as a part of the University Hospital or in a private hospital immediately adjacent, permits of some private work being done, with the expenditure of a relatively small amount of time. Further, in some of the hospitals of recent construction which are under the complete control of the University, private consulting-rooms and waiting-rooms are provided in the hospital for the use of the "whole-time" professor. Thus one of them told me that he did not give more than about an hour a day to private work, but it enabled him to double his official salary.

In other Universities the salaries are less, and one is warranted in speaking of the professors as half-time professors. As a rule they receive salaries of £1000 to £1500 a year, for which I certainly think they give a very adequate return to the University.

It must be borne in mind in connection with all these Chairs in America, that the senior assistant is nearly always a full-time Associate Professor and receives a salary which is very considerably larger than assistants get in this country. It is not possible to use one figure for the whole country, but I made special notes of the actual salaries in various places. For

Medical Education, etc., in the United States

example, in one school the half-time Professor of Medicine received \$3000 a year, and his two assistants each received the same salary but gave their whole time to the work. I also noted that one of these graduated five and the other six years previously. In another instance the senior's salary was \$3600; the second man received \$3000 and was full-time, the third, \$1200, was part time; and the fourth, \$700, was full time. This last was a young man who occupied a position in the department somewhat analogous to the Resident Medical Officers of some of the English hospitals.

My English colleagues on the Commission, who courteously furnished me with an advance copy of their report, find themselves, as I do, unable to express a definite opinion one way or the other in this matter. The difficulties are temperamental. Some men who have the right to practise if they wish hardly exercise it; others who have no right obviously chafe under the restriction, and there is a good deal to be said for the argument that it is rather hard that in, at any rate, the smaller University centres the services of the most capable physician and surgeon in the city are not available for the well-to-do. It is, in my judgment, impossible to lay down any hard-and-fast rule. The solution seems to be the careful selection of a man who will place his University duties first, and who is not bound by any too hard line.

Four methods have been suggested, namely (1) that the professor should devote his whole time to his hospital and research duties; (2) that he may see private patients but not receive any remuneration for so doing; (3) that fees shall be charged to those patients and handed to the hospital; (4) that it be left to the discretion of the professor how much private work he may do without interfering with his University duties, and any fees received are his own property.

I should add here, to show that America, rich as she is, is not exempt from the common troubles of the world, that serious difficulties are apprehended in the near future with reference to the filling of the more strictly scientific Chairs (Anatomy and Physiology, etc.).

The High Cost of Living, or H.C.L. as it is commonly called, has told severely on these professors. Before the war their salaries were usually 5000 dollars—a little more than £1000 a year. That amount doesn't go far in America to-day. Most of them have been raised to 6000 dollars—at the present rate of

Norman Walker

exchange £1500. But the contrast between that and the larger incomes earnable in any kind of practice is having a deterrent effect on the rising generation, and the possibility of filling some of these Chairs—especially physiology—by non-medical men is being seriously considered.

HOSPITALS.—In 1890 I wrote, "Then the hospitals are not in any way connected with most of the Schools; the Professor may happen to be a physician or surgeon to the hospital, but it is quite as likely that he is not. In many cases the State, City, or County Hospital is the only one available for clinical instruction, and it may be situated miles from the Medical School."

The position is indeed changed in those thirty years. Now the connection between School and Hospital is as close as it is possible to be. In many instances the University is the actual proprietor of the hospital, and in nearly all the others which we visited they have almost complete administrative control of it in its purely medical aspects.

I think there is here something which we may note with special interest, and the study of it should do much to allay the fears of those who are apprehensive that any State interference necessarily interferes with efficiency.

I do not make reference in this connection to those hospitals like the Peter Bent Brigham Hospital in Boston, nor the Barnes Hospital in St Louis, nor to the Johns Hopkins, where the hospital and the University are one; but it is interesting to note that in Minneapolis, in Ann Arbor, and in Iowa City the hospitals are the property of the States of Minnesota, Michigan, and Iowa, and in Cincinnati of the city of Cincinnati, and that by arrangement the respective Universities in those places administer the hospital and appoint the staff.

I made very particular and repeated enquiries as to the working of this system, and I was assured by everyone that it worked smoothly and most satisfactorily. I was particularly interested in Cincinnati, because in that city the University is, as in Edinburgh, the town's College. The city is responsible not only for the hospitals but for the financial arrangements of the University; and I was assured by the President of the University, in reply to my public question, pressed, I fear, by supplementary questioning which may have seemed strange to some of those present, that there had not been the slightest friction between the city and the University in this dual arrangement, and that he did not see any reason why there ever should

Medical Education, etc., in the United States

be. In reply to my insistent questions as to how this was assured, he referred me to the agreement between the University and the city, and promised to send me a copy of it. This he has since done. It is in the form of a new charter for the city, of which this arrangement was one of the clauses, and it was adopted by popular vote on a referendum.

The pretty little town of Iowa City, a town of, I should say, 10,000 inhabitants, once the capital of the State, now transferred to Des Moines, contains a hospital of about 250 beds, and a children's hospital, not yet completed but partly occupied, which I think might challenge comparison with any in the world. The State, which is responsible both for the University and the hospital, arranges for the transfer to this hospital of suitable cases from all parts of the State, and the result is that the supply of cases for teaching is exceptionally adequate. For the maintenance of each of its patients the State pays the hospital \$3.50 a day = £1.

The Middle West is the most live part of America. Both the Presidential candidates are sons of Ohio, and that State, Michigan, Illinois, Minnesota, and Iowa are tackling the problems of the Public Health with a zeal which is not surpassed even by our Consultative Councils. They are young, they are enthusiastic, they are rich, and they are not hampered by any of our old-world fear of making mistakes. I was much interested to learn that more than one half of the legislators of Iowa are University graduates. They recognise that there is not much more important to a community than well-educated doctors and they are prepared to pay for their education. I think I am right in saying that in each of these State or city Universities the cost of each student's education is five times what he pays; the community thinks it good business to pay the balance. It does not seem to have had the effect of drying up the streams of private benevolence. Money bulks rather largely in American conversation, and we heard again and again of gifts or bequests of half a million, one million, in one case of seven million dollars.

Chicago is contemplating an enormous extension in connection with its Universities. A new University hospital is being erected with a large laboratory building on the University Campus. The University of Illinois Medical School has bought a base-ball field immediately adjacent to its Cook County Hospital (over 2000 beds), and on it it

Norman Walker

is intended to erect a series of pavilions for the reception and study of groups of diseases. The scheme is the outcome of co-operation between the State Department of Public Welfare and the University of Illinois, and it is estimated to cost 17,000,000 dollars. The North-Western Medical School is also planning extensive enlargement.

Nothing interested me more in connection with hospitals than the department of Social Service, which I saw closest in its birthplace, the Massachusetts General Hospital. Introduced in 1905, its parent, Dr Richard Cabot, was able to say in his Ether Day address (1919), that it had become an established part of all first-rate hospitals in America. It is a follow-up system, both in- and out-patient, and has attained a most gratifying success. Last year 811 patients were referred to it from the Wards, and over ten times that number from the Out-Patient Departments. I envied my colleague Prof. White the increased opportunities of usefulness with which it provided him. I think this was the thing I envied most in America.

The main object of our visit to America was to see the standard of medical education now attained in that country, and to inspect the Examination of the National Board of Examiners so that we might report to the British Licensing Boards how far these might be recognised.

I am glad to say that my colleagues were equally impressed with myself, and we have each recommended our Boards that American physicians who hold the certificate of the National Board may be admitted to our Final Examinations without further question.

By a fortunate accident in the day of meeting the Scottish Board secured priority in deciding to accept the recommendation, and last week I had a letter from Admiral Braisted warmly acknowledging the receipt of the information and saying how helpful it would be to them. I do not suppose that there is anything in this troubled world more important than the maintenance of cordial relations between ourselves and the United States, and it has been an enormous satisfaction to me to have been the humble instrument of doing something which will, I feel sure, do not a little in this direction.

CLINICAL RECORDS

CASES ILLUSTRATING THE INFLUENCE OF TRAUMA ON THE DISTRIBUTION OF PSORIASIS.

By WILLIAM D. D. SMALL, M.D., F.R.C.P.E.

IT has been frequently observed that cutaneous trauma plays some part in determining the distribution of Psoriasis. Thus in a psoriatic subject, it is common to find that a lesion of the disease makes its appearance along the line of a scratch, at the site of a tattoo mark, or in the neighbourhood of a vaccination or operation scar. As a rule, the psoriasis is at the time in a state of more or less active eruption, but cases occasionally occur in which during the stage of quiescence some injury appears *to the patient* to be responsible for inducing a fresh outbreak.

This influence of trauma on the distribution of psoriasis was seen in an exaggerated degree under war conditions amongst troops of the B.E.F., France. There were two distinct groups of cases :—

(1) Those in which the disease first made its appearance in the neighbourhood of a gunshot or other wound, and was followed some time later by a more or less general outbreak of the eruption.

(2) Those in which the psoriasis became superimposed upon some other cutaneous malady from which the patient was suffering. In these cases, the psoriasis adopted the distribution of its predecessor, all or most of whose manifestations became psoriatic. Thus we might see the disease occurring in the situations usually affected by scabies, when it would be most marked between the fingers, on the fronts of the wrists, and on the penis. Similarly in cases of impetiginous or other eruptions, the site of the psoriasis was determined by that of the original disease. The size and general outline of each area of psoriasis also corresponded exactly with those of the antecedent lesions.

Both the above classes of case were distinctly rare, but the instances met with usually presented features of a very striking nature. The following may be taken as typical examples :—

William D. D. Small

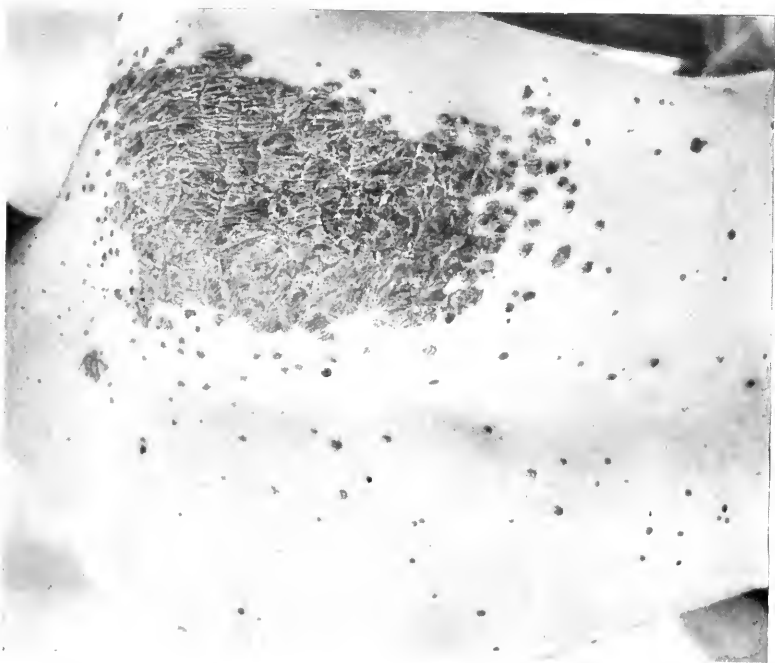
Psoriasis Occurring in Relation to Wounds.

CASE I.—Pte. B., aged 31, was wounded in the back by a sniper on 3rd March 1917. The bullet was deflected by his equipment and caused a superficial wound some 5 inches long in the region of the right scapula. As it became slightly septic, it was dressed with boric fomentations. About 2nd April a little redness and irritation appeared round the wound, and this his medical officer thought to be due to the dressing, describing it as a "burn." The redness continued to extend and the skin became somewhat infiltrated and scaly, but no lesions appeared on any other part of the body. The patient being familiar with psoriasis, from his previous attacks, suggested that it might be the cause, but in the absence of other evidence, the original diagnosis was retained. Some ten days later, a few small lesions of typical psoriasis made their appearance on the elbows and knees, and still later the scalp, trunk, and limbs became affected. His condition, on coming under my observation on 22nd April, is sufficiently well shown in the accompanying photograph (Fig. 1.). The large area of psoriasis corresponding to the wound and its immediate surroundings is quite apparent, and also the small discrete lesions on the trunk. The patient had sixteen months' service, during which period there was no evidence of psoriasis. He had had three previous attacks of the disease, the first at the age of 21, each succeeding one at an interval of two to three years. His mother had suffered with it all her life, and one sister had it slightly. Three other members of the family were healthy.

Psoriasis following Scabies and Impetigo.

CASE II.—Pte. C., aged 27, was admitted to hospital on 6th February 1918. He was suffering from a severe generalised eruption of scabies, which was complicated by marked secondary pyoderma. He had also a small area of psoriasis on each elbow and knee, which he stated he had had for about two years. He had served for three and a half years in the army, for the last two and a half of which he had been overseas. He had never had any skin trouble before going to France. There was no family history of psoriasis. By 18th February the scabies and pyoderma had greatly improved under treatment, but it was noticed that the lesions were changing in character, and that they were becoming dry and slightly scaly. After a short period, all of them had definitely taken on the typical features of psoriasis, and this corresponded exactly in distribution and in form with the original eruption (Fig. 2). The scalp appeared free from the disease.

The diseases which were observed as determining in this way the distribution of psoriasis were scabies, seborrhœa, and various forms of impetigo.



CASE I.

Psoriasis following gun-shot wound of back.



CASE II.

Psoriasis following and taking on the distribution of Scabies.



Case of Idiopathic Tetanus

The similarity of distribution of the lesions in certain cases of seborrhœa and of psoriasis has been put forward as one argument in support of the view that the two conditions are in reality varieties of the same pathological entity. This apparent resemblance, however, is readily explicable in the light of the type of case recorded above—psoriasis in a seborrhœic subject being likely to have its distribution influenced by the pre-existing seborrhœa. The little that is definitely known regarding the etiology of psoriasis seems to indicate that it is systemic rather than local in origin. It appears, however, that local injury of the skin plays a more important part in many cases in determining the distribution of the eruption than has hitherto been generally conceded. Possibly the almost constant occurrence of the disease upon the knees and elbows may be attributable to the greater degree of friction to which these parts are subject.

CASE OF IDIOPATHIC TETANUS.

By R. A. FLEMING, M.D., F.R.C.P.E., Physician, Royal Infirmary, Edinburgh.

CASE.—J. T., aged 20, a watchmaker, was recommended for admission to Ward 23 by Dr Macdonald on 26th September 1920. He first complained on 17th September of difficulty of swallowing and stiffness of his jaw, gradually leading to complete closure. Before admission to hospital he had definite spasmodic attacks, but these increased much in severity after admission.

There was no wound discoverable, and his trade might be reckoned a protected one. He had done no outside work in which he was likely to come in contact with tetanus bacilli. He stated, however, that he occasionally pricked his fingers with the sharp instruments he used at his work.

On the day of admission he had, according to his own statement, about ninety spasms induced by any movement or noise. The spasms, besides the typical risus sardonicus, produced a degree of opisthotonos and most painful contraction of the abdominal muscles and especially the recti. On admission the temperature was 99.5° F., pulse 96, and respirations 24 per minute. There was difficulty in swallowing, and owing to the clenched teeth he could only take fluid food. The spasms varied in intensity—the worst lasting 4 minutes while the majority of severe ones were about 1½-2 minutes.

R. A. Fleming

The number of spasms during day and night are interesting :—

	From Admission at	Spasmodic Attacks.
Sept. 27th	3 P.M. to 8 P.M.	19
27th and 28th	8 P.M. „ 8 A.M.	42
28th	8 A.M. „ 8 P.M.	60
28th and 29th	8 P.M. „ 8 A.M.	37
29th	8 A.M. „ 8 P.M.	92
29th and 30th	8 P.M. „ 8 A.M.	25
30th	8 A.M. „ 8 P.M.	47
30th to Oct. 1st	8 P.M. „ 8 A.M.	7

After this the spasms ceased entirely.

It will be noted that the spasms were more numerous during the day than during the night, due probably to the Ward being less quiet even though every precaution was taken. The severe attacks, in which he often bit his tongue, generally also occurred during the day.

Treatment by antitetanus serum was only begun on the 28th September, partly because the case at first sight resembled a very severe tetany rather than true tetanus, but mainly because we had not been able to obtain a sufficient supply of serum. On the 28th September the patient's temperature had risen to 100° F., and he had obtained no sleep during the night, the 30 grains of bromide of potassium combined with 20 grains of chloral repeated every eight hours having proved absolutely insufficient.

He was therefore given on the 28th September 16,000 units of tetanus-antitoxic serum intrathecally and 3000 hypodermically.

On the 29th September he got 16,000 intrathecally and 7500 hypodermically.

On the 30th September 16,000 intrathecally and 3000 hypodermically.

The supply of serum was exhausted on the 1st October, but he got 3000 units hypodermically on the 2nd October. The temperature fell to normal on the 1st October and he made an uneventful recovery. A good deal of stiffness of the jaw, neck, back, and abdominal muscles remained for nearly a fortnight.

Besides the spasms, the special trouble during the three days when the patient was acutely ill was sleeplessness with consequent exhaustion.

This case appears to be worth putting on record because idiopathic tetanus is rare and because the recovery was undoubtedly due to adequate treatment with serum.

CRITICAL REVIEW

"PROBLEMS OF POPULATION AND PARENTHOOD."

The National Birth-rate Commission's Second Report.

By J. W. BALLANTYNE, M.D., F.R.C.P.E.

WHEN, in 1916, the National Birth-rate Commission issued its First report under the title of *The Declining Birth-rate: its Causes and Effects*, it was at once recognised that the inquiry could scarcely be left at the point to which it had been brought. The somewhat full summary of the results obtained which appeared in these pages* showed that the investigation had been mainly an analytical and statistical one, from which the large fact of a declining birth-rate due chiefly to voluntary restriction of conception clearly emerged; obviously there was another aspect of the subject, which one might call the synthetic or constructive, which remained for consideration if the Commission were not to fail to reach its purpose. But the nation was giving all its energies to the prosecution of the war which had then reached its mid-point, and it caused no surprise when the Birth-rate Commission temporarily intermitted its functions. The continued destruction of life on the Continent of Europe, however, appealed so strongly to the vision and conscience of the members of the Commission that they decided that even during the continuance of the war the inquiry must be resumed, further evidence taken, and a further report issued dealing with certain new elements which had come into the problem of population, and striving to reach some practical results which might be pressed upon the nation. Accordingly the Commission was reconstituted and began hearing evidence on 13th May 1918.

It was a considerably altered Commission which met, for absences due to war and health had to be provided for. Scotland with four members as against one in the first Commission secured a fairer representation, and the women increased from eight to twelve; there were twelve medical men and one medical woman; and the total number of members was forty-one. Forty-six witnesses were examined and the minutes of evidence cover 423 pages of the Report, which is entitled *Problems of Population and Parenthood*. The Introduction (by the Secretary, Mr James Marchant, C.B.E.), the Report itself, and

* *Edin. Med. Journ.*, 1916, N.S., xvii., pp. 100-110.

J. W. Ballantyne

the Notes of Reservation occupy 166 pages. The evidence was received on twenty-seven occasions, the last being 21st November 1919.

The Terms of Reference.

The terms of reference to the reconstituted Commission were ten in number. *First*, the extreme and persistent fall of the legitimate birth-rate in the United Kingdom, and the causes and prevention of the illegitimate birth-rate. *Second*, the influence of antenatal (foetal) disease and death in the decline of the birth-rate, and the causes of foetal death during labour at or near full term. *Third*, the contemporary movements of population in the Dominions, and the proportional distribution of the sexes throughout the Empire. *Fourth*, the economic problems of parenthood in view of the rise of prices and taxation and their possible solutions. *Fifth*, the housing problems in relation to parenthood. *Sixth*, the present spread of venereal disease, the chief cause of sterility and degeneracy, and the further menace of these diseases during demobilisation. *Seventh*, the increased industrial employment of women of child-bearing age. *Eighth*, the differential or qualitative aspects of the present birth-rate. *Ninth*, the constitution and uses of the coming Ministry of Health as an instrument of racial reconstruction. *Tenth*, the need of a census immediately after the war, and of a permanent anthropometric department in the Ministry of Health.

The conclusions were grouped under five headings:—(1) recent statistics of the birth-rate; (2) the voluntary restriction of the birth-rate; (3) the loss of infants; (4) contributory causes of loss of population; and (5) outline of further inquiry. Those under heading 3 are entirely obstetrical, those under number 4 are largely medical, and medical questions enter to a great or a small degree into the other three. It is not surprising, therefore, that sixteen medical witnesses were called out of a total of forty-six. The Lord Bishop of Birmingham acted as President, Dr Mary Scharlieb and Principal A. E. Garvie, D.D., were Vice-Presidents, and Dr C. W. Saleeby was Chairman of Committee. Eight sub-committees aided in the work of drafting the Report.

The Birth-rate since 1912.

The *first* section deals with recent statistics of the birth-rate. It was necessary that this matter should be considered, for in the first Report the last year for which the birth-rate was stated was 1912, when it was 23.8. The rates for the years 1913-18 are given for England and Wales, for Scotland, and for Ireland, and the legitimate is separated from the illegitimate rate in each case. The Commission

“ Problems of Population and Parenthood ”

was wise to separate these two rates, for, as may be anticipated, the years of war affected them in different fashion. The legitimate birth-rate for England and Wales fell steadily and seriously from 1913 (when it was 23.1) to 1917 (when it was 16.8); in 1918 the rapidity of the fall was checked (for it fell only to 16.6). The fall in Scotland differed in the fact that 1914 saw a slight recovery, the rate rising to 24.2 as against 23.7 in 1913; then, as in England and Wales, the steady decrease was resumed so that in 1917 it was 18.6, and it remained at that in 1918. In Ireland the fall was from 22.2 in 1913 to 19.1 in 1917, and there was a slight recovery in 1918 to 19.3. The Commission was of opinion that this was just the result which the years of war might be expected to produce, and that it gave no special occasion for uneasiness. The testing time would come in 1919 and the following years, when it would be seen to what extent fertility would be restored with the restoration of family life made possible by the demobilisation. It was hardly to be expected that the illegitimate birth-rate would be affected similarly by war, and, as a matter of statistics, the illegitimacy rate (*i.e.* per 1000 of the population) for England and Wales increased from 1.0 in 1913 to 1.1 in 1918, whilst in Scotland and Ireland the rate calculated in the same way was practically stationary. When, however, the illegitimate births were reckoned in percentages of the total births, it became at once evident that there was a distinct increase. Thus, in England and Wales, they (the illegitimate births) increased from 4.3 to 6.3 per cent., in Scotland from 7.1 to 7.9, and in Ireland from 2.8 to 3.1 per cent. The Commission ascribed this increase to the movement of young womanhood from the shelter of home to conditions of life (in munition works, etc.) more independent and more exposed.

After a careful study of the factors involved, the Commission came to the conclusion that the total loss of births in England and Wales attributable to the war was 543,087. In other words, had the fall of the birth-rate continued at the same speed as it was showing before the war, the number of births during the four years of war would have been 3,321,668; it was 2,778,581, the difference or a little over half a million was the amount directly to be ascribed to the war conditions. Against this loss the Commission was fortunately in the position to set a decline in infant mortality due to child welfare work, to the substitution of safer forms of infant foods than cows' milk, to the fall in the birth-rate itself, and to a movement of which traces were present before the war; unfortunately the full value of this gain was not obtained because of the disastrous influenza epidemic of 1918. In other words, child welfare and the other ameliorating influences had to struggle against both war and pestilence, a conjunction of evil forces which has been proverbial. The decline in the Scottish birth-

J. W. Ballantyne

rate was a little less than that in the English, whilst the decline in Scotland's infant mortality was a little more, but the Scottish figures were less studied by the Commission than they deserved, and in this fact perhaps is to be found one of the reasons why there is now a Scottish Committee meeting in Edinburgh to consider the special aspects of the subject prevailing north of the Tweed.

The Commission rightly places great emphasis upon fertility in different social strata in the population. The discovery that differential fertility was much lower among the upper and middle classes than among the manual workers and especially among the lower working class was, at the time of the issuing of the First Report, considered as possibly nothing more than a recognition of what had always been. Yet the nation had prospered and might therefore be expected to go on prospering. The ranks were being replenished mainly from below, that was all. It is now possible, from statistics made available, to carry the investigation back to the middle of the nineteenth century, with the result that the class differences in fertility were then quite small; indeed they may have been non-existent a little further back still. This result the Commission rightly regard as of ominous significance. It is worth while to underline their conclusion: "*the differential fertility of the least prosperous and successful classes is seen to be a new feature, so far as we can judge, of the birth-rate situation, and we can, therefore, no longer argue that it has probably been proved by experience to be compatible with national advancement and prosperity.*" It is ominous.

Voluntary Restriction of the Birth-rate.

The *second* section contains the conclusions reached regarding the voluntary restriction of the birth-rate. It is one of the most important causes of the birth-rate's decline; that was shown in the First Report. It began with the educated and professional classes and it is now spreading through the whole community, for child-bearing is tedious, domestic assistance is hard to get, education is costly, and many parents wish to make more adequate provision for their female children's future. The ethical aspects of birth-control are taken first. The Commission found some six common agreements. There is *first* what may be called an obstetrical one: "except under medical advice and action with a view to removing serious maternal risks, no means should be used to terminate the pregnancy when there is a possibility that conception may have taken place." Antenatal life is thus declared to be sacred from the time of conception, a great advance in ethics; it is wrong to destroy even an embryo of a few weeks unless to save the mother's life. There is *second* a eugenic agreement: "no persons who are likely to transmit any serious physical or mental taint should

“Problems of Population and Parenthood”

have children.” The difficulty here is, of course, the determination of the “unfit” and their compulsion or persuasion to be childless. The *third* is medical: “no preventive means which could injure the health of potential parents or children should be used.” It is easy to agree upon this conclusion, but at the present time it is practically impossible to define the “injurious means.” Even in respect of means of prevention usually regarded now as non-injurious the late results cannot yet be known and may prove to be not devoid of risk to health especially in the sphere of the nervous system. The *fourth* agreement is purely ethical and may be readily accepted: “no husband or wife should refuse the duties of parenthood for solely selfish reasons.” But selfishness is wonderfully and firmly intertwined with the other strands which make up human character. The *fifth* is an agreement in economics; it is, that it is the duty of society to remove the disabilities which, without any fault of theirs, may be imposed on worthy parenthood. Of course there must obviously be safeguards. Further, the Commission recognises that there are arguments against as well as for the endowment of motherhood, and it wisely leaves the question open for fuller consideration in a Third Report. The *sixth* matter of agreement is the necessity for education of the young in the laws of sex hygiene, in the prevalence and dangers of venereal disease, and in several other matters of health in relation to marriage and family life. This is essential in view of the spread of incomplete or misleading information concerning contraceptives; and a large part of the Third Report is to be devoted to the consideration of the nature and mode of dissemination of the fullest and best information.

These six matters of common agreement are followed by a very carefully balanced statement of the arguments for and against the use of contraceptives. These are mainly ethical and religious, and no view is stated in the Report itself upon the possible medical dangers of contraceptives; in two Notes of Reservation at the end of the document, however, the matter is dealt with. The first Note has eleven signatures (including five of the medical Commissioners) and is to the effect that “routine interference with the spontaneity of so important a physiological function (as marital association) will sooner or later produce varying degrees of physical and mental exhaustion, often associated with lack of concentration, loss of memory, and increasing irritability and unrest, so that marriage may cease to be a satisfied bond of union.” The second Note (with four signatures, including one Doctor of Medicine) declares that “the routine interference with the spontaneity of so important a physiological function as the sex act does not take place with the best contraceptive methods; and that physical and mental exhaustion, often associated with lack of concentration, loss of memory, and increasing irritability and unrest which cause

J. W. Ballantyne

marriage to cease to be a satisfied bond of union, are chiefly due to the use of "self-control" in the form of "coitus interruptus," of improper preventatives, or of unnatural abstention." On this extraordinarily important point, therefore, the Commission is divided. It may be suggested that the time has hardly yet arrived when an opinion on the injuriousness or safety of any form of contraceptive can be finally formed; *a priori*, one would expect that interference with the sex act if it results in injury at all would give rise to somewhat slowly arising symptoms in the nervous system gradually reaching alarming manifestations. It is doubtful whether the widespread employment of contraceptives has lasted long enough yet to yield evidence on a large enough scale to justify the expression of any definite conclusion. Other members of the Commission dissent from the argument for the use of contraceptives on moral and religious grounds and assent to the argument against such use. The division of the Commission on this important question to a considerable degree reflects a similar division outside the Commission, in the Church, and among the laity, including the medical profession. Whether a *via media* between the two extremes (short of the simple employment of abstinence for honest motives) can be found is doubtful. What might satisfy medical fears of physical injury would not necessarily meet the difficulty of endangered morals.

An interesting paragraph is given to the ethics of the limitation of the family, a matter closely related to the discussion of the use of contraceptives but not identical with it. Here in few words the Commission deals with an immense amount of evidence placed before it from Neo-Malthusian, Eugenic, and similar sources. The words are "there may be conditions in which an increase of the population is not desirable; but in the United Kingdom, and still more in the Empire, these conditions do not now exist." It is added that "worthy parenthood is a service to the nation, the Empire, and the race." At the same time, the responsibility of the country to parents in the discharge of their obligations must equally be asserted, and this leads the Commission naturally on to the economic and social aspects of the question of population, and inspires the proposed solutions of the difficulty by the endowment of motherhood and the care of the unmarried mother (illegitimacy). In this connection one important but often unrecognised new factor is that "recent legislation has effectually destroyed the child of the poor as an economic asset." No one can possibly doubt that the legislation which restricted child labour in factories and the like was beneficent, and no one would dare to propose to repeal it; but as a matter of fact its result has been to make juvenile labour scarce and so to raise wages for the upkeep of the working-class home. Another curious side result of legislation

“Problems of Population and Parenthood”

followed when the Ministry of Munitions discharged women who were found to be pregnant; the act was humane and beneficent, but the effect was to induce women to conceal their condition or even to get rid of the product of conception in order to continue as wage earners. Obviously these happenings are an argument for State aid in some form, although perhaps it may not yet be possible to decide upon any special kind of endowment of motherhood or of parenthood.

Infantile Deaths, Antenatal and Early Postnatal.

The *third* section of the Report deals with three important matters which are almost wholly medical or rather obstetrical, viz., the mortalities associated with birth, those which occur in the first year of life, and the closely allied subjects of lactation and the milk supply. The whole of this section is full and accurate and shows the Commission is a working mood and well supplied with expert information; the result is admirable and is not controversial. A distinction is wisely drawn between antenatal, intranatal, neonatal, and infantile mortality, and the emphasis is rightly thrown upon the neonatal for the reason that whilst a marked improvement has in recent years taken place in regard to infantile mortality, very little if any impression has been made upon neonatal deaths. Still-births are known to amount to about 30 per 1000 births, and miscarriages are estimated to be about four times as many, so that altogether about 150 per 1000 births are lost by intranatal and antenatal fatalities: the deaths in the first month of life (neonatal) amount to about 37 per 1000 live births, and the infantile mortality (which of course includes the neonatal) used to be about 100 per 1000 live births, and is now about ten less (90 per 1000) although one cannot count upon it remaining at that level when an epidemic sweeps the country. The great losses to the population before and immediately after birth are thus recognised, and the Commission reaches the right conclusion that their diminution is largely a problem in obstetrics for the antenatal, intranatal, and neonatal deaths, and in lactation and the milk supply for the later ones. This conclusion is reinforced by an exposition of the causes of these antenatal deaths (premature births, toxæmias and hæmorrhages of pregnancy, pelvic contractions, etc.); their amelioration is rightly regarded as in the sphere of the maternal section of mother and child welfare. The prevention of the deaths after the first month of life belongs to the province of child welfare and its beneficent schemes, to which full credit is given. The neonatal deaths lying as they do between the care of the obstetrician and of the paedrist have not so far been greatly checked, and obviously new constructive efforts to deal with them are sorely needed. In this connection the evil influence of

J. W. Ballantyne

syphilis and alcohol as "racial poisons" is not forgotten, and a large part of the fourth section is given up to the consideration of the difficult problems which these causes of loss of population raise.

The Venereal Diseases, Alcoholism, etc.

The *fourth* section has for title "Contributory Causes of Loss of Population," and a large part of it is concerned with the venereal diseases (syphilis and gonorrhœa) and their control; another part is devoted to parental alcoholism; and a page or two to the laws of marriage and divorce. The Commission is, of course, dependent to a great extent upon the findings of the Royal Commission on the Venereal Diseases, but it applies them specially to the loss of young life (antenatal and neonatal). The importance of syphilis is shown by the following statement: "It is estimated that in urban districts 25 per cent. of the total antenatal deaths and deaths during the first two or three weeks after birth, are due to syphilitic infection of the fertilised ovum or foetus, and that probably 20 per cent. would be a fair percentage over the whole of England and Wales; this would mean that about 27,000 deaths occur annually in England and Wales from syphilis during the antenatal, intranatal, and neonatal periods." To this number must, of course, be added the infants who show no signs of syphilis at birth and yet develop such signs later, with the setting up of weak health and it may be with actual death following. Salvarsan or its substitutes will do much to check the ravages of the disease, but congenital syphilis is rarely cured if the treatment is begun after birth, a very strong argument if one were needed for the establishment of antenatal wards for the reception of syphilitic expectant mothers. Gonorrhœa is a cause rather of sterility than of disease before birth, but its evil influence in causing congenital blindness by setting up ophthalmia neonatorum by an intranatal infection must never be forgotten; so it diminishes the birth-rate, and also handicaps the children who are born by the eye changes it produces. Here again a useful means of prevention is at work in the form of careful treatment of the eyes immediately after birth. Every effort should be made to cure vaginal gonorrhœa during pregnancy, but it has to be admitted that the best means has not yet been discovered to effect this end.

The whole of this fourth section of the Report is well written and informative, but where moral problems are raised (as necessarily they must be) the Commission loses its unanimity. The rock of cleavage is in respect of prevention, and especially in regard to the use of the "prophylactic packet" or disinfection at early treatment centres. It is necessary here to quote a few sentences from the Report itself—"The moral point at issue may be stated as follows: How far is it

“Problems of Population and Parenthood”

right to give an antiseptic powder to a man who is going, casually or deliberately, to indulge in illicit sexual intercourse? Is it a moral attitude for the State to arrange that an individual man or woman should be able to get such “packets” and to make himself or herself theoretically secure against infection?” Incidentally it has to be admitted that even in the hands of disciplined men, as in the Army and Navy, the use of prophylactic packets is not infallible. Early treatment centres are more effective, and the Commission goes so far as to state that the establishment of such is desirable in urban districts, but it is admitted (in a footnote) that to apply them to civilians would be difficult without arranging for night clinics, and that to set them up all over the country is obviously impossible. So “the National Birth-rate Commission desire to record their opinion that, in view of the gravity of the venereal disease problem, the Ministry of Health would be justified in calling the attention of the public to the fact that abstinence from promiscuous sexual intercourse is the only thoroughly effective method of preventing the spread of disease, and that it is the urgent duty of every citizen who indulges in promiscuous sexual intercourse in disregard of the claims of sex morality and citizenship, and thereby exposes himself or herself to the risk of infection, to use some method of disinfection, either personal, immediately after intercourse, or by private medical treatment, or by attendance at an early treatment centre at the earliest opportunity.” As to the best means for obtaining immediate disinfection, the Commission are evidently not strongly of one mind; they agree, however, with the Ministry of Health that “the official application of a packet system to the general community is neither desirable nor practicable.” If self-disinfection turn out to be more effective than disinfection at early treatment centres, they are prepared to make it easy for persons to obtain such disinfectants from registered chemists, provided they are sold only when accompanied by “a notice that they are to be used for disinfection only and are useless for treatment.” As might be expected, there are dissentients among the members of the Commission on these matters. Eleven are not prepared to commit themselves to the support of any proposals that the means of self-disinfection should be freely supplied to the public generally, or that without further inquiry a system of compulsory notification should be adopted, “as we fear that such a step might lead to the re-enactment of the Contagious Diseases Acts.” A small group of four “cannot endorse the views expressed in the Report *re* the prevention of venereal disease, as we consider them evasive, confusing, and not up to date . . .” Dr Chalmers, the Medical Officer for Glasgow, stands alone in dissenting from the suggestion that “the terms of the Venereal Disease Act, 1917, be relaxed without further experience as to their value . . .”; and Sir

J. W. Ballantyne

Rider Haggard, K.B.E., reserves his opinion, as he did not hear the evidence.

A great many other social problems await solution, and the Commission refer to some of them in very guarded terms, and suggest another Royal Commission or Interdepartmental Committee on the Venereal Diseases. There is the unsolved problem of the compulsory notification and treatment of the venereal diseases. On this subject the Commission are of opinion that notification and treatment are intimately associated, one without the other seeming to be useless, and they recognise the difficulties and come to a finding as follows: "The Birth-rate Commission realise these and other difficulties involved in the introduction of any efficient scheme of compulsory notification and treatment of venereal diseases, but they feel that it has now passed the experimental stage, both in our Colonies and in forty out of the forty-eight United States of America, and that it is advisable for the State to make a trial of compulsory notification and treatment in this country, provided that there should be no return to the principle or practice of the Contagious Diseases Act." Another unsolved problem is that of the sexual relations of venereally diseased persons, and, of course, the problem differs somewhat according as the persons are married or unmarried: in the former, the question of pre-matrimonial health certificates is paramount, and this brings in the delicate matter of professional confidence, and these questions are immediately followed by others in connection with the law as it exists on the subject of decree of separation or nullity of marriage. Other supremely difficult matters are those concerned with prostitution, alcohol in relation to venereal disease, and the confidential character of medical death certificates as regards persons dying from diseases due primarily to venereal infection. On the last-named question, obviously of great importance to the medical profession, the Commission urges that the Registrar-General's recommendations should be duly considered by the Government. Briefly stated, they were, that two death certificates should be used, one of which would be formal, for the relatives and to permit of registration, and the other confidential and showing the primary cause of death. This plan would be of great service.

Future Investigation.

The *fifth* section of the Report deals with the work to be done by the Commission, and it may be noted that it is now being prosecuted by the Commission itself in London and by Scottish and Welsh Committees. It has as its main purpose the problems associated with the education of the young for worthy parenthood, including instruction

“ Problems of Population and Parenthood ”

in sex, hygiene, and in numerous physiological and psychological matters allied thereto.

General Conclusion.

The whole Report is a document of immense importance, and the division of opinion which it reveals on certain aspects of the subjects dealt with is no matter for surprise. Possibly if the Commission had consisted solely of doctors or solely of clergymen there might have been a closer agreement ; but the matters considered have ethical and religious as well as medical and obstetrical aspects, and it is difficult to see how a separation of these can, under the circumstances, be justified.

NEW BOOKS

Syphilis in General Practice: with Special Reference to the Tropics.

By K. K. CHATTERJI, F.R.C.S.I. Pp. xx+382, with 56 illustrations. Calcutta and London: Butterworth & Co. 1920. Price 15 rupees.

Among the many volumes appearing on venereal disease this one is of interest in that it deals fully with the modifications of the disease as seen in the Tropics, where gross skin and mucous membrane lesions are more common than in this country. With very few exceptions the author considers the Wassermann test specific and reliable, these being chiefly in tropical diseases which are often clinically distinguishable. His observations on this test confirm the latest work in this country that malarial subjects do not give a positive reaction three weeks after fever has subsided, even if the patient is the host of malarial parasites. The chapters dealing with diagnosis are carefully written and the colour illustrations good. The chapters dealing with treatment, and especially arsenical treatment are not so exhaustive. While the technique of the various methods of administration of salvarsan and its substitutes is carefully described, practitioners not accustomed to using these drugs will find little to guide them in prescribing the continuous treatment so often necessary after the initial intensive course. The author's work on the therapeutic action of the margosic esters, and especially his original work on the combination of ethyl ester margosic with arsenic, mercury, and iodides in the treatment of syphilitic manifestations, is interesting. In view of the failure of salvarsan as a parasitotropic agent completely to sterilise the patient, this action of the margosic esters in breaking up the lipoid globulin protecting the organism of syphilis and exposing it to the antispirochætal drug combined with it, merits attention. We shall be interested to have some further results of the author's work in this direction.

Orthopædics for Practitioners. By PAUL BERNARD ROTH, F.R.C.S.

Pp. xii+195, with 57 illustrations. London: Edward Arnold. 1920. Price 10s. 6d. net.

The author intends this book to be "an introduction to the practical treatment of the commoner deformities," and in it he sets forth his present views, the result of his long and extensive experience.

He is to be congratulated on producing so excellent and compact a book at so opportune a time, and in addressing it to the requirements of the practitioner. Interest in orthopædics has been greatly stimulated

New Books

as a result of the war, because so many gunshot wounds develop into orthopædic problems. The interest thus aroused will bear fruit in a more general knowledge and in a better understanding of the general principles that underlie the treatment of the more common deformities. In confining the scope of the work to the needs of the practitioner, the author emphasises the great importance of early diagnosis and of the early commencement of treatment.

Advanced and neglected cases and the details of operative treatment are wisely left to larger works.

The book is full of wise guidance and of useful and practical hints. A strong vein of common sense is noticeable throughout, and when the author is critical of methods recommended by others, his objections are clearly stated and his alternatives well tested in his own experience.

In a chapter devoted to fractures the teaching of Arbuthnot Lane—"correct alignment"—is combined with that of Lucas Championnière—"mobilisation and massage."

In the treatment of tuberculous joints the conservative method is upheld and the operative condemned.

In discussing artificial limbs the author states courageously that "in the lower limb the end of the stump must not take any weight of the body"—and that except in Syme's amputation "an end-bearing appliance is undesirable, for it is sure to lead to discomfort."

An appendix deals with Thomas's splints and concludes a most instructive, well-written, and well-illustrated book.

A Dictionary of Scientific Terms: Pronunciation, Derivation, and Definition of Terms in Biology, Botany, Zoology, Anatomy, Cytology, Embryology, Physiology. By I. F. HENDERSON, M.A., and W. D. HENDERSON, M.A., B.Sc., Ph.D., F.R.S.E. Pp. vii. + 354. Edinburgh: Oliver and Boyd. 1920. Price 18s. net.

As is stated in the title, *A Dictionary of Scientific Terms* deals only with those in use in certain subjects corresponding roughly with those taught in the first two years of medical study, with the exception of Chemistry. It will prove eminently useful for students of Medicine and Science, and in so far as we have been able to test it, the work has shown itself thoroughly reliable. We miss some eponymous terms in Anatomy, such as Vidian nerve, Gartner's duct, foramen of Monro, and Stenson's duct; but of course it must be very difficult for a Dictionary-maker to know where to draw the line. Only one meaning of mesometrium (that of the B.N.A.) is given. *Balaustion* means flower of the wild pomegranate, not "tree-blossom," as most readers of Browning know. The work is finely printed on good paper and is easy of reference.

NOTES ON BOOKS

Dr H. L. Tidy's *Synopsis of Medicine* (Wright, price 26s. net) aims at providing a condensed synopsis of all the principles of medicine (causes, symptoms, pathology, treatment, etc.). The careful use of varieties of type makes reference rapid and easy. While it is too concise for a student obtaining his first knowledge of medicine, it is admirably adapted to the needs of a busy practitioner who desires to refresh his memory on a particular subject, or even for the teacher preparing a lecture.

The second edition of *The Systematic Treatment of Gonorrhœa in the Male*, by Norman Lumb, O.B.E. (H. K. Lewis & Co., Ltd., price 5s. net), is supplemented by short notes on detoxicated vaccines and a few of the colloidal chemo-therapeutic agents lately advocated. The author is no more enthusiastic over the therapeutic action of colloidal manganese and colloidal palladium in urethritis than he is over mercury, and still holds the view that local surgical treatment, assisted by a course of vaccine therapy, is the best method of eradicating the disease. Some will think that he is unduly enthusiastic over the results of vaccine treated cases. In a book which deals almost solely with treatment, and which states that a patient, "obtaining correct treatment early, will need the shorter time on treatment," the omission of information regarding the better known methods of abortive treatment and their technique is regrettable. Apart from this minor defect this volume contains a great deal of sound and practical advice regarding the routine examination and treatment of gonorrhœa.

In spite of some faults, *Medico-Tropical Practice* (second edition), by Gilbert E. Brooke (Charles Griffin & Co.), might well find a place in the library of any practitioner in the tropics. In addition to a full account of tropical diseases there is a great deal of other information, and such subjects as the tropical environment, tables of weights, measures, humidity and percentage solutions, how to make paper spittoons, the care of books, how to lacquer brass and photographic tips, are included. Unfortunately a good deal of the subject-matter has escaped revision. *Proteid* and *hydrochlorate* are used throughout for *protein* and *hydrochloride*. It is stated that Gowers' hæmocytometer is the instrument in common use. The old palpation method of reading the blood-pressure is recommended. In the treatment of malaria we are told that the *intramuscular* method of giving quinine

Notes on Books

is not advisable, and the author seems to think it necessary to make a skin incision in order to give an intravenous injection. Convalescence is treated at German watering-places and the description of malarial cachexia rather suggests the old confusion with kala azar. In spite of the teaching of the war, milk diet is recommended in the treatment of dysentery, and there is no mention of the treatment of bilharzia disease by intravenous tartar emetic. The coloured plates are not very happy and there are numerous misprints. The book, however, has many solid merits.

Diseases of the Eye, by M. S. Mayou (third edition, Henry Frowde and Hodder & Stoughton, price 10s. 6d. net) has been brought up to date by the addition of new material, and will maintain its recognised position among the smaller text-books.

The sixth edition of Dr Dudley W. Buxton's well-known book on *Anæsthetics* (H. K. Lewis & Co., Ltd., price 21s. net) may be recommended as a thoroughly up-to-date account of the principles and practice of anæsthesia. The book has been revised and in part rewritten, a notable addition being a survey of recent work on shock and the relation of anæsthesia thereto. The illustrations are numerous and satisfactory.

A Handbook of Midwifery, by Comyns Berkeley (Cassell & Co., 1920, price 7s. 6d.), appearing as a fifth edition, revised, enlarged, and partly rewritten, has more than ever to commend it, to midwife and student alike.

Dr James B. Mennell, in revising his *Massage, its Principles and Practice* (J. & A. Churchill, price 21s.), has added considerably to it from further experience gained in treating war injuries. Dr Mennell is a past-master in the art of massage and movement, and his book cannot fail to be of great value to practitioners and masseurs of experience. All through the book strong emphasis is laid on the point that it is the surgeon who must take the full responsibility of the treatment, and that the masseur must be fully cognisant of the aims in view, and instructions as to the lines of treatment be clear and adequate. Dr Mennell describes his convictions and methods as unorthodox, but anyone who reads his book or has followed his methods will be convinced of their value, which, to quote from his words, are "persuasive and rarely coercive." The first chapters are devoted to the general principles of massage, followed by detailed and lucid explanations of the movements and exercises, excellently illustrated. The remainder of the book is devoted to treatment of various medical and surgical conditions. The book is most clear and convincing, and

Notes on Books

embraces the subject in all its aspects, and ought to fulfil one of the objects for which it was written—that of assisting practitioners when issuing instructions to their masseurs.

The Theory and Practice of Massage, by Beatrice M. Copestake, now in its third edition (H. K. Lewis, price 12s. 6d.), has already taken its place as a text-book among teachers and students. It is only when finished what is an all too short training that masseuses begin to realise their limitations, and the necessity of further study. Miss Copestake's chapters on Swedish massage and exercises contains, in addition to her own work, many extracts from standard books, and being well illustrated is one which beginners cannot fail to find useful.

The well-earned reputation of Hutchison and Rainy's *Clinical Methods* (Cassell & Co., price 12s. 6d.) makes detailed review unnecessary. It is now in its seventh edition, and is not only a book for undergraduates, but will be found useful by the general practitioner, who is not in close touch with a teaching school or a good laboratory.

We reviewed the third edition of *Essentials of Physiology*, by F. A. Bainbridge and J. A. Menzies (Longmans & Co., price 14s. net), so recently that further comment is unnecessary. This edition has been revised and some new figures added. We consider this the most satisfactory of the smaller text-books of physiology on the market.

Hitherto there has been no book in English dealing with the organisation and maintenance of Vaccine establishments in the tropics, and thus Col. W. G. King, I.M.S., in writing *Vaccination in the Tropics* (London: Tropical Diseases Bureau, 1920, 5s. net) has done a useful piece of work. The first part of the book deals with the practice of vaccination, including advice as to how to meet the difficulties depending on climate, bad transport, etc.; the greater part is devoted to a description of the conduct of vaccine establishments. The volume seems to us excellent.

The fourth edition of the late Dr G. Herschell's *Text-book of Indigestion* (London: Edward Arnold, 1920) has been revised and rewritten by A. Abrahams in a wholly satisfactory manner. The book is short, the treatment recommended is full of useful details, and the sections on examination are simple. It may be noted that Dr Abrahams especially lauds screening as superior to radiographs in diagnosis.

BOOKS RECEIVED

BARDSWELL, NOEL. Handbook for Tuberculosis Workers (<i>John Bale, Sons & Danielsson, Ltd.</i>)	1s. 6d.
BLAKE, A. J. JEX-. Physical Signs in the Chest and Abdomen (<i>J. & A. Churchill</i>)	9s. 6d.
BRAM, ISRAEL. Exophthalmic Goitre and its Nonsurgical Treatment (<i>Henry Kimpton</i>)	32s.
COPE, ZACHARY. Surgical Aspects of Dysentery (<i>Henry Frowde and Hodder & Stoughton</i>)	12s. 6d.
CROSSEN, HARRY STURGEON. Operative Gynecology. Second Edition (<i>Henry Kimpton</i>)	63s.
DUTTON, THOMAS. Obesity: Its Treatment. Second Edition (<i>Henry Kimpton</i>)	2s. 6d.
GALLEMAERTS, E., and G. KLEEFIELD. Etude Microscopique de l'Œil Vivant (<i>Librairie Octave Doin</i>)	—
GOODHART, Sir JAMES FREDERIC. Edited by G. F. Still. The Diseases of Children. Eleventh Edition (<i>J. & A. Churchill</i>)	32s.
HEWLETT, R. TANNER, and A. T. NANKIVELL. The Principles of Preventive Medicine (<i>J. & A. Churchill</i>)	21s.
HURST, ARTHUR F. The Psychology of the Special Senses and their Functional Disorders (<i>Henry Frowde and Hodder & Stoughton</i>)	12s. 6d.
IBBOTSON, WILLIAM. Atlas of the Sensory Cutaneous Nerves (<i>The Scientific Press, Ltd.</i>)	7s. 6d.
INTERNATIONAL CLINQUES. Vols. i., ii., iii., Thirtieth Series. 1920 (<i>J. B. Lippincott Company</i>)	42s. per set 4 vols.
JARDINE, ROBERT. Text-Book of Midwifery for Nurses. Seventh Edition (<i>Henry Kimpton</i>)	7s. 6d.
JELLETT, HENRY. A Short Practice of Midwifery. Eighth Edition (<i>J. & A. Churchill</i>)	18s.
JOHNS HOPKINS HOSPITAL REPORTS. Vol. xix. 1920 (<i>The Johns Hopkins Press</i>)	—
JONES, WALTER. Nucleic Acids (Monograph on Biochemistry) (<i>Longmans, Green & Co.</i>)	9s.
KELLY, HOWARD A., and WALTER L. BURRAGE. American Medical Biographies (<i>The Norman Remington Company</i>)	\$15.00
KERR, J. M. MUNRO, and JAMES HENDRY. Notes on Midwifery. Second Edition (<i>Maclehose, Jackson & Co.</i>)	10s. 6d.
LYDSTON, G. FRANK. Impotence, Sterility, and Sex Gland Implantation (<i>The Riverton Press</i>)	—
MACLEOD, J. J. R. Physiology and Biochemistry in Modern Medicine. Third Edition (<i>Henry Kimpton</i>)	42s.
MACLEOD, J. M. H. Diseases of the Skin (<i>H. K. Lewis & Co., Ltd.</i>)	70s.
M'MURRICH, J. PLAYFAIR. The Development of the Human Body. Sixth Edition (<i>Henry Kimpton</i>)	18s.
MANN, M. Translated by A. R. Moodie. Textbook of Tracheo-Bronchoscopy (<i>John Bale, Sons & Danielsson, Ltd.</i>)	—

Books Received

MARTIN, EDWARD, BENJAMIN A. THOMAS, and STIRLING W. MOORHEAD.		
White and Martin's "Genito-urinary Surgery and Venereal Diseases."		
Twelfth Edition	(<i>J. B. Lippincott Company</i>)	35s.
MAUBLANC, Dr, and Dr RATIE.	The Medical Examination of Airmen	
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Edinburgh Medical Journal

February 1921

INTESTINAL TUBERCULOSIS.*

By F. M. CAIRD, Emeritus Professor of Clinical Surgery,
University of Edinburgh.

THIS communication is mainly based upon a consideration of forty-three consecutive cases of Intestinal Tuberculosis treated in hospital, including the series of eleven published in our *Transactions* and in the *Scottish Medical and Surgical Journal* for 1904. Clinical points and operative procedures are more fully detailed in that paper, to which reference can be made so that repetition is unnecessary; but the growing literature on the subject and extended experience have since afforded additional information. The conclusions arrived at in the former paper remain practically unaltered.

Tubercle is a common affection of the intestinal tract. Two marked types may be recognised, which differ widely. One is acute and destructive, the other chronic and formative; there is, however, no definite dividing line.

The first and most familiar type is secondary to pulmonary phthisis. It is due to direct infection from swallowed sputum, and is characterised by extensive intestinal ulcerative lesions associated with diarrhoea. It may be regarded as one of the manifestations in declining health of advanced phthisis, and pursues a rapidly fatal course. It comes under ken of the physician.

The second type is relatively rarer. There may be no pulmonary mischief present, or but little, and that quiescent. Infection occurs through the blood or lymph-stream. The lesion takes the form of localised hyperplastic strictures, formative rather than destructive, and associated with constipation. The treatment is surgical.

In speaking of the first type, Conradt¹ indicates three paths

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4th November 1920.

by which tuberculous infection reaches the bowel: firstly, by contaminated food, such as milk; secondly, by swallowed sputum in phthisis pulmonalis; thirdly, by metastasis through the blood and lymph-stream from distant pulmonary foci. He demonstrates the frequency of this well-known form by quoting certain statistics. Thus Eisenhardt found that in 1000 autopsies of adult pulmonary phthisis 563 had intestinal tubercle and of these 489 had vomicae. Ronseff, in 800 similar examinations, found 46 per cent. with intestinal tuberculosis, and Harnan in 832 found 68 per cent. A still higher percentage is reported by other investigators. Rarely was there evidence of healing observed. It is noteworthy that the œsophagus and stomach escape. Eisenhardt met with but one example in the latter.

It is the second, the hyperplastic or hypertrophic type, which calls for special attention. It seems to be widely distributed throughout the civilised world. Cases are reported from Great Britain, Scandinavia, France, Germany, Middle Europe, Russia, Italy, Japan, North America, as well as Turkey, Portugal, and South America.

To what extent bovine infection may be responsible is not established. It is interesting that Shiota¹³ states that none of his cases had ever partaken of milk.

The general clinical history and subsequent events of the forty-three cases observed will be found in the general epitome, and aided by selected plates and figures appended. Unfortunately several preparations laid aside for future examination were destroyed during the war, so that the exact extent of the pathological change was not always ascertained and cannot be represented in section, although the external site of the lesion can be recognised by the local congestion and other features. The following table gives the age and sex:—

Age in years.	Male.	Female.	Total.
1 to 10 . . .	1	1	2
11 „ 20 . . .	5	3	8
21 „ 30 . . .	3	9	12
31 „ 40 . . .	3	10	13
41 „ 50 . . .	1	3	4
51 „ 60 . . .	...	1	1
61 „ 70 . . .	3	...	3
Totals . . .	16	27	43

Intestinal Tuberculosis

The chief site of the lesion is found at the ileo-cæcal region, a part predisposed to inflammation from anatomical and physiological reasons. The appendix and lymphatic glands of the ileo-cæcal angle may play a leading rôle. The initial changes associated with the presence of the bacillus are alike irrespective of the mode of entrance. Tuberculous nodules develop in the submucous and subserous layers; these spread, coalesce, and rupture on the free surface of the mucosa, where they give rise to the well-known ulceration, travelling in a circular direction and following the course of the lymphatics along the mesenteric supply of the bowel. In the first or destructive type the general virulence of the ulceration may quickly carry off the patient prior to perforation of the gut, which is a rare sequel. A fœcal fistula or a fistula bimucosa may occasionally result from the formation of an abscess with mixed infection, when plastic inflammation unites adjacent serous surfaces. This may occur in both forms. But in the second type, which is distinguished by such a great proliferation of connective tissue, perforation into the free peritoneal space is rendered well-nigh impossible. The destructive advance becomes checked by changes which recall the fibromatosis seen in some cases of pyloric ulcer and carcinoma, or again in keloid. It is this extraordinary hypertrophy which constitutes the leading pathological feature, and also constitutes the leading danger, that of stenosis from the associated longitudinal and circular contraction of the new fibrous tissue. Thus are occasioned the Protean strictures encountered, which may vary from string-like bands (Case 7, Pl. I.), hypertrophic clustering areas (6 and 7, Pl. I.), and polypoidal clumps blocking the lumen of the bowel, on to bobbin-shaped carcinoma-like masses (5, Pl. I.), and tunnels (22, Pl. III.) which barely admit a probe. The tumour-like swelling may be freely mobile, as frequently happens when the serum is affected, or again as in the cæcal region it may be more fixed and adherent. The appendix may have disappeared by incorporation into the general mass (9, Pl. II.). The bowel above the obstruction tends to hypertrophy and dilate; below to atrophy.

The whole process appears to be one in which the resisting powers of the patient permit an exaggerated connective tissue reaction and defence against a mild attack by organisms sparse in number and of low vitality. It has been compared to what occurs in lupus hypertrophicus. It is a curious fact that this

very attempt to effect a cure by free proliferation should defeat its object and conduce to a fatal issue. Nature is unable to deal successfully with the accident of situation. In other organs, such as the lung, a salutary result would probably ensue; or again, as in the case of joints, the surgeon can guide the healing process so as to avoid the crippling effect of untrammelled contraction or malposition.

Definite symptoms may not be excited for a considerable time, and at first may be attributed to some passing ailment of the digestive tract or to constipation. Eventually, however, the salient features of colic and vomiting peculiar to obstruction appear, varied it may be by diarrhoea when ulcerative or other irritating conditions supervene.

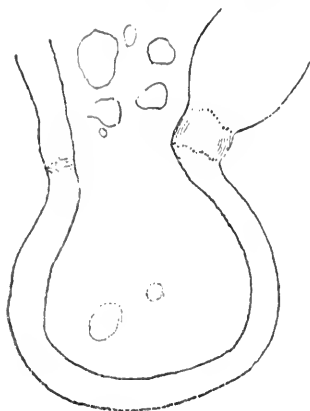
Inspection of the abdomen reveals ladder-like and other peristaltic patterns, local or even general distension, together with resistant swelling more or less tender on pressure. Borborygmi and intestinal sounds may be heard and provoked. It is occasionally possible to palpate enlarged mesenteric glands, and the aspect of the patient may suggest "intestinal stasis."

A correct diagnosis was not always made. Some cases with a relatively short history were not discriminated from subacute appendicitis; in others, the mimicry of malignant disease was so perfect that the doubt was only solved on histological examination of the preparation after operation. Guidance was sought by inquiry into the chronicity of the ailment, as also into the family and personal history as regards tubercle. On eighteen occasions definite evidence of the latter was forthcoming as under, in—

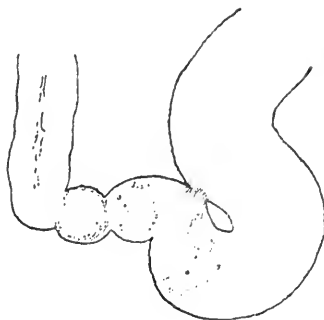
- 1 case the father, mother, and sister suffered from tubercle.
- 4 cases the father only suffered from tubercle.
- 1 case the mother and sister suffered from tubercle.
- 1 case the mother only suffered from tubercle.
- 3 cases brothers or sisters suffered from tubercle.
- 3 cases the offspring suffered from tubercle.
- 5 cases the patient: tuberculous glands, etc.

To this list must be added the revelations found at later autopsies when old pulmonary phthisis was found three times; it became active after operation once, and one case had tuberculous Fallopian tubes. Thus in all twenty-three out of forty-three cases gave some personal or more commonly family tuberculous taint. Klebs and Leube hold that intestinal tuberculosis cannot arise without a focus elsewhere; it will be observed that in most of the above cases the intestinal lesion

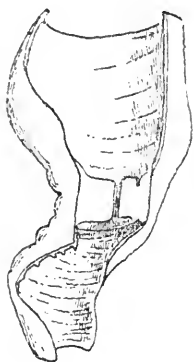
Intestinal Tuberculosis



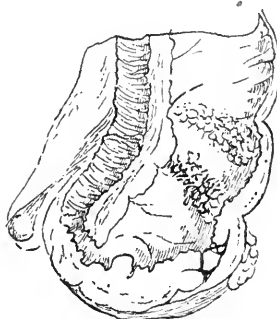
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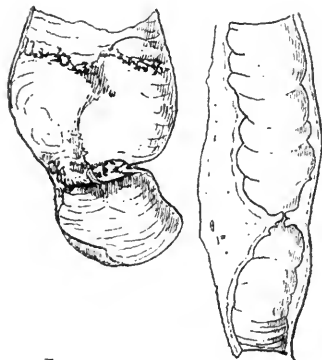
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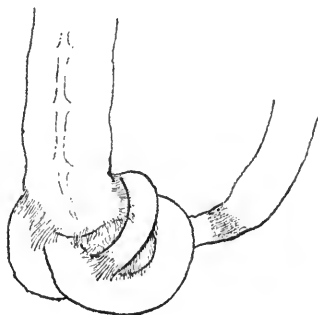
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6.



7.



8.

appeared to be local and primary, the pulmonary focus was lacking.

An interesting combination of tubercle and carcinoma³ was discovered on microscopic examination of the preparation removed from Case 11. A second similar specimen was obtained but does not figure in the list since it was destroyed prior to microscopic examination. But it would appear that the combination is not very rare since Stettin¹¹ and others record several instances. The question is raised as to which is the primary factor. The invasion of malignant disease by tubercle is discussed by Franco.¹² We are all familiar with malignant disease following upon lupus and chronic ulceration.

The peculiar sequence of tuberculous peritonitis arising after an abdominal operation on patients who then presented no evidence of tubercle has also been experienced. It occurred one year after pyloro-gastrectomy for carcinoma (26, Pl. III.), and in a second patient months after successful suture of a perforated gastric ulcer.

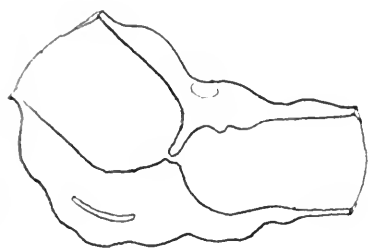
The multiplicity, the sites, and the polymorphic appearance of the strictures observed may be gathered from the four illustrative plates. While no part of the intestinal tract escapes, the frequency of the lesion increases from the upper reaches of the jejunum downwards, till the maximum is attained at the ileo-cæcal region. From thence onwards the ratio diminishes from the ascending and transverse colon onwards to the rectum. The sites observed may be approximately localised thus:—

Jejunum only	.	.	.	.	.	1
Ileum only.	.	.	.	.	.	14
Ileum and ileo-cæcal valve	.	.	.	.	.	11
Ileo-cæcal valve	.	.	.	.	.	8
Ileo-cæcal valve and colon	.	.	.	.	.	5
Transverse colon	.	.	.	.	.	2
Abscess, involving small or both guts	.	.	.	.	.	2
						<u>43</u>

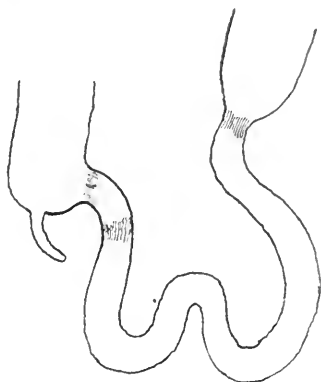
The presence of younger zones of stricture in various stages of formation above what appears to be a primary and more fully developed one (6 and 7, Pl. I.) suggests the occasional possibility of an ascending infection.

It is astonishing that the intestinal functions continue in the presence of such extreme stenosis, as seen in Figs. 5, Pl. I., and 22, Pl. III. The fluid and gaseous contents of the small intestine pass with ease until such time as the diminishing lumen calls

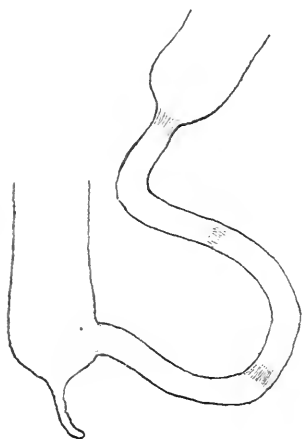
Intestinal Tuberculosis



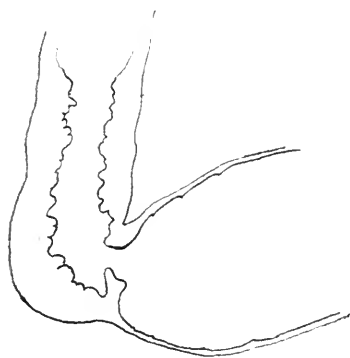
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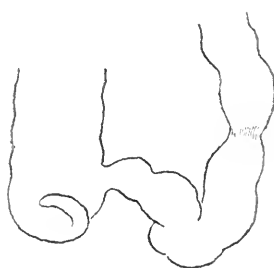
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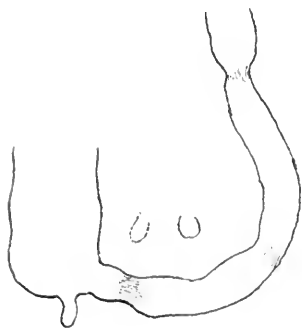
17.

forth the climax of complete obstruction, aided it may be by local congestion or the impaction of indigestible or foreign bodies (33, 40, Pl. IV.). The extreme dilatation and hypertrophy with obliteration of the valvulæ conniventes above the strictured area is figured on Pl. I. (5 and 6). The small intestine may come to rival the colon in size, even mimic the condition seen in Hirschsprung's disease. The stomach-like saccular dilatation between two strictures removed from Case 29, Pl. IV., is most unusual.

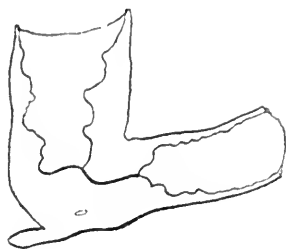
Attention has already been drawn to the appendix and glands of the ileo-cæcal angle as primary sites of tubercle. Many surgeons have had experience of cases in which the condition of the appendix and glands raised no doubt as to their tuberculous nature. Indeed it has been verified histologically. And yet after removal of the appendix alone, the glands being left *in situ*, recovery of the patient is generally excellent and permanent. Such results seem to emphasise the curable nature of tubercle after the removal of the greater and more active focus, and may also illustrate the beneficial effect attributed to exploratory incision in cases of peritoneal tuberculosis generally. On the other hand, we are not surprised to find that an occasional return of the disease may take place at a later date. Thus Rehn (Jena) narrates an instance of this kind in which four years after such an appendectomy, ileo-cæcal resection was required for hyperplastic stricture. General tuberculous peritonitis has also been known to follow. We also meet with cases in which the fœcal fistula formed after an apparently simple suppurative appendicitis has taken on tuberculous inflammation.

The treatment of hyperplastic stricture practically follows the principles common to that of malignant disease of the intestine. It aims at a free and complete resection of the affected area, including generally the ileo-cæcal region. There is not, however, the same necessity as in carcinoma for removal of all the enlarged glands, and much should not be risked in this respect. Short circuiting should be reserved to overcome destruction when excision is impracticable, and may pave the way for subsequent resection. The mortality after lateral anastomosis is not so great as that from excision but it should not replace the latter unless the condition of the patient precludes it. The end results are, of course, more hopeful than in carcinomatous stricture, hence it has been strongly advocated

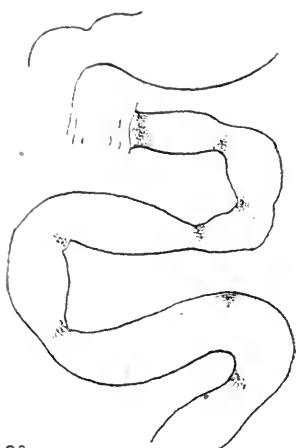
Intestinal Tuberculosis



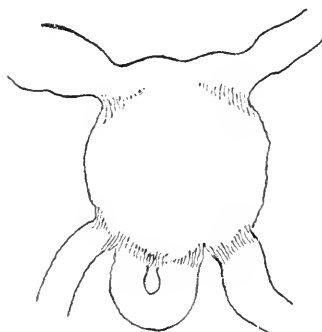
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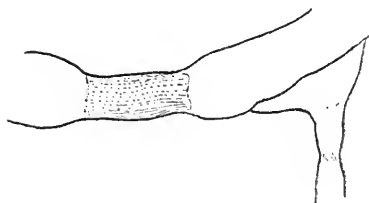
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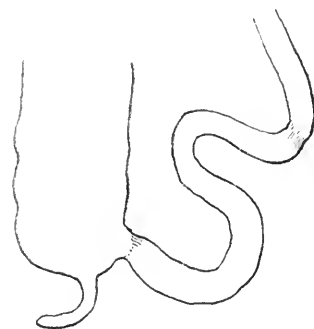
23



25.



26.



28.

by some. Gayet reports a case where there were twenty strictures of the jejunum, and cure was obtained after anastomosis below the last jejunal stricture and the cæcum. Berard and Roust performed with good result a jejuno-ileostomy and an ileo-sigmoidostomy, thus excluding one and a half metres of the small intestine, in a case with multiple stenoses. Anterior gastro-jejunostomy was employed in Case 23, Pl. III.

The number of operations performed on the forty-three patients cited was augmented, since after a variable prolongation of hopeful quiescence, further interference was required in five. Thus there were forty-eight operations and thirteen deaths. One case succumbed to perforation of a jejunal ulceration and another to rupture of a large suppurating gland filled with foul-smelling pus, which gave way during operation. Shock and peritonitis also caused fatalities.

The following tables are epitomised from the general concluding list in which the history of the individual cases is given:—

Cases.	Operative results.			
		Operation.	Recovered.	Died.
13 died in hospital.	Resection	1st	27	12
13 „ at home.	„	2nd	2	
14 alive recently.	Short circuiting	1st	3	1
3 not traced.	„ etc.	2nd	3	
43			35	13

Tubercle was the probable cause of death in many of the thirteen cases that have perished since leaving hospital, but exact information could not always be obtained. The relief afforded was sometimes of but short duration; in others life was considerably prolonged and there remain some where we may hope for permanent good health:—

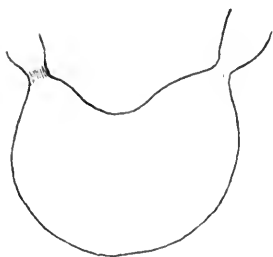
Died at Home.

5 within 6 months, 3 of tubercle, 2 of other or unknown cause.						
4	„	12	„	3	„	1 „
2	„	2	years	1	„	1 „
1	„	5	„	0	„	1 „
1	„	12	„	1	„	0 „

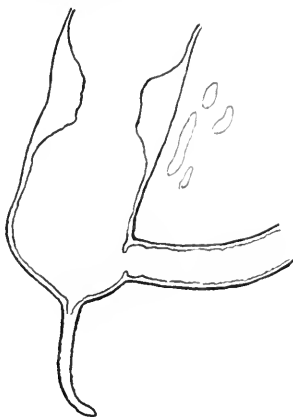
Alive when last heard of.

5 after 2 years.		2 after 14 years.	
1	„ 4 „	1	„ 15 „
2	„ 5 „	1	„ 18 „
2	„ 11 „		

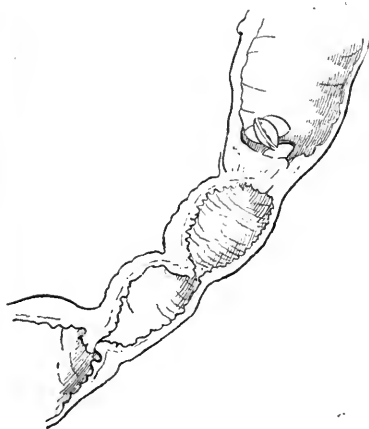
Intestinal Tuberculosis



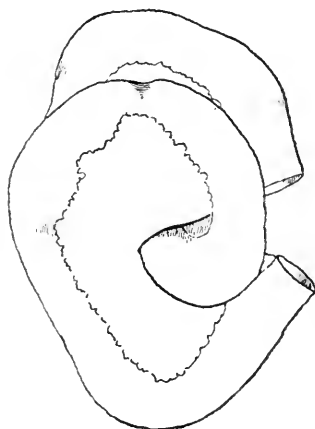
29.



32.



33



36.



38.



40.

Attention may now be drawn to a few short summaries from various writers. The list of authors following will be found to yield a copious bibliography on consultation. Unfortunately Italian journals were not available.

Nikoljski² sums up that the condition is secondary in half the cases. It generally occurs between 20 and 40 years of age, is rare before 10, and still rarer after 60. Intestinal strictures of year-long duration are in the majority of cases tuberculous, and this holds good of similar cases when the etiology is not clear. The treatment is purely surgical (resection) and the earlier the operation the better the result, although not brilliant.

Baum⁶ regards the condition as a pure hypertrophic form of primary intestinal tubercle. Appendicitis plays a part in its development. The histology has a similarity to that of lupus hypertrophicus in the paucity of bacilli. The best operative procedure is resection at one sitting. Exclusion, short circuiting, should be reserved for very exhausted patients, and in all cases with widespread peritoneal tuberculosis simple laparotomy must suffice. Shiota¹³ reports twenty-four cases from Japan. He makes the interesting observation that none of the patients had drunk milk. He discusses various pathological points, as also do Els¹¹ and Wieting.⁵

Küttner¹⁴ refers to his own and a collected series of in all fourteen cases affecting the colon, noting the strong resemblance to carcinoma.

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²Nikoljski, *Volkmann's Saml. (Innere Med.)*, 1903, vol. cclxii. ³Caird, *Trans. Ed. Med. Soc.*, 1904. ⁴Campiche, *Deutsch. Zeitsch. f. Chirurgie*, 1905, vol. lxxx. ⁵Wieting, *Ibid.*, 1905, vol. lxxviii. ⁶Baum, *Münch. Med. Wochensh.*, 1906. ⁷Ito and Asahara, *Deutsch. Zeitsch. f. Chirurgie*, 1906, vol. lxxxii. ⁸Brunner, *Tuberculose etc. des Darm Kanals, Deutsch. Chirurgie*, 1907. ⁹Hartman, *Brit. Med. Journ.*, 1907. ¹⁰Pringle, *Glasgow Med. Journ.*, 1907. ¹¹Els, *Beit. z. Klin. Chirurgie*, 1908, vol. lxiii. ¹²Franco, *Virchow's Archives*, 1908, vol. cxci. ¹³Shiota, *Archiv. f. Klin. Chirurgie*, 1909, vol. lxxxvii. ¹⁴Küttner, *Deutsch. Zeitsch. f. Chirurgie*, 1909, vol. c.
¹⁵Rubesch, *Beit. z. Klin. Chirurgie*, 1909, vol. lxiv. ¹⁶Stettin, *Festschrift zur 40 jährigen Stiftungsfeier des Deutschen Hospitals*, New York, 1909.
¹⁷Subbotic, *Zentralb. f. Chirurgie*, 1910. ¹⁸Piery and Mandoul, *Revue de Médecine*, 1913, vol. xxxiii. ¹⁹Bérard et Alamartine, "Appendice et Tuberculose," *Lyon Chirurgie*, 1913, vol. ix. ²⁰Christides, *Arch. a. d. Geb. Path. Anatomie*, 1914, vol. ix. ²¹Hülse, *Virchow's Archives*, 1914, vol. ccxvii.

Intestinal Tuberculosis

DESCRIPTION OF PLATES

PLATE I.

- CASE 4b. J. A., age 16, second operation, ileum, enterectomy. Jan. 1904, R.
" 4c. J. A., age 18, third operation, short circuiting, ileum and trans. colon. Oct. 1906, R.
" 5. J. K., age 61, bobbin-like mass, ileum. Dec. 1901, R.
" 6. P. M., age 68, various stages of clustering hyperplastic areas, ileum. Dec. 1902, R.
" 7. J. M., age 57, left figure hyperplastic areas, right figure string stricture, ileum. April 1902, R.
" 8. Mrs B., age 34, ileum knotted around cæcum, adhesions, stricture. May 1902 +.

PLATE II.

- CASE 9. Miss C. B., age 30, lumen of appendix seen in section of mass. Oct. 1902, R.
" 12. Miss K. H., age 17, multiple strictures. March 1904 +.
" 14. Miss T. S., age 35, multiple strictures. July 1904 +.
" 15. Miss T. H., age 18, ileo-cæcal and colon. August 1904, R.
" 16. Miss R. T., age 39, terminal stricture ileum, tubercles on serosa, glands. R.
" 17. G. I., age 20, ileum. Nov. 1904, R.

PLATE III.

- CASE 18. Mrs C. H., age 29, multiple strictures. June 1905, R.
" 22. J. M., age 23, ileo-cæcal tunnel. May 1906, R.
" 23. A. W., age 35, strictures in first 16 ins. of jejunum, anterior gastro-jejunostomy. June 1906, R.
" 25. R. S., age 47, tuberculous ileum and trans. colon, adherent to mass of caseating glands. June 1906, R.
" 26. Miss I. P., age 36, tuberculous strictures after pyloro-gastrectomy for carcinoma. Nov. 1906, R.
" 28. Miss T. N., age 22, strictures of terminal ileum. April 1907, R.

PLATE IV.

- CASE 29. Mrs B., age 32, stomach-like dilatation between strictures, ileum. March 1908, R.
" 32. G. R., age 16, stricture, ascending colon. Dec. 1909, R.
" 33. Mrs C. T., age 57, strictures; obstruction by damson stones, ileum. Dec. 1909 +.
" 36. S. E., age 41, strictures, ileum. Dec. 1915, R.
" 38. G. S., age 18, ileo-cæcal. Feb. 1916, R.
" 40. Miss F. M., strictures, orange peel, pips and husk of date, ileo-cæcal. May 1916, R.

F. M. Caird

No.	Name.	Age.	History.	Condition on Admission.
1	Miss N. S. . . .	7	3 years ; paroxysmal pain, iliac region, right ; increasing.	Rather emaciated ; tumid abdomen ; patterns.
2	Magnus S. . . .	9	Diarrhœa; swelling of abdomen.	Tumid abdomen ; ladder patterns.
3	W. R. L. . . .	24	Since boyhood abdominal pain, distension, irregular action of bowels ; acute symptoms 3 weeks.	Badly nourished, result of intemperance and bronchitis ; subacute obstruction, colic, vomiting; distension patterns.
4	Jas. A. . . .	12	2 months ; loss of appetite, malaise, and during last month constipation and colic.	Puny, badly nourished ; abdomen tumid, tense, rigid ; ladder patterns ; vomiting.
	„ 2nd operation	16	Similar symptoms returned about 1 month ago.	Badly nourished; adenoids; condition not so pronounced as formerly ; borborygmi.
	„ 3rd operation	18	Getting thinner for last 2 months; some diarrhœa, colic.	Borborygmi ; intestinal splashing ; patterns.
5	John K.. . . .	61	Many years constipation; eight last months nausea and vomiting ; emaciation. Mother died of phthisis.	Very thin; abdomen distended; ladder patterns ; borborygmi ; splashing.
	„ 2nd operation	62	Doing well; operation for piles, April 1902. Lately again loss of weight and very weak.	Distended abdomen; emaciated.
6	Peter M. . . .	68	6 years colic and gastric catarrh ; always constipated ; piles 4 or 5 years. .	Poor condition ; abdomen distended; swelling in left hypochondria region ; peristalsis ; tinkling ; borborygmi.
7	John M. . . .	57	6½ years; abdominal pain, vomiting (takes opium), slight diarrhœa lately, excessive thirst. Sister died of phthisis.	Anæmic, emaciated ; intestinal gurgling and splashing.

Intestinal Tuberculosis

Findings at Operation.	Operation.	Result.	After-History.
Papillomatous stricture; ileo-cæcal; greatly hypertrophied ileum, atrophied colon; caseating glands.	Resection; ileo-cæcal; two-stage operation, 1 and 5.6.1895; end-to-end union.	Recovered.	Well, 1910.
Papillomatous stricture; ileo-cæcal; ulcer.	Resection; ileo-cæcal; end-to-end. 1899.	Recovered.	Well, 1910.
Intestines matted by firm adhesions, dense and vascular; stenosed ileo-cæcal region.	Resection; ileo-cæcal, pouch tubes inserted. 25.5.90	Died, 28.5.90. Did not rally.	
Annular fibroid stricture of ileum; hypertrophy above and atrophy below; glands.	Resection; 6 in. ileum; end-to-end union. 31.7.1901.	Recovered.	
Two strictures lower portion of ileum; glands.	Resection; 24 in. ileum; end-to-end union. 21.1.1904.	Recovered.	
Strictures of ileo-cæcal region and ileum; tubercles on visceral serosa of intestine; mesenteric glands infected to jejunal root and in omentum.	Lateral anastomosis between ileum and transverse colon. 21.10.06.	Recovered.	Died summer 1907; marasmus.
Bobbin-like stricture 22 inches from ileo-cæcal valve; glands.	Resection; 80 inches; ileo-cæcal; two-stage operation. 14 and 16.12.01.	Recovered.	Died Dec. 1902. Gradual exhaustion; sectio; large perforating ulcer of sigmoid flexure communicating with caseating retroperitoneal gland; mesenteric glands caseating; tuberculous gumma of liver; old phthisical cavity apex right lung.
General enlargement of mesenteric glands.	Laparotomy only. 8.02.	Recovered.	
Strictures of ileum; ileum and glands, matted, adherent to descending colon.	Resection; 40 in. ileum; end-to-end union. 19.12.01.	Recovered.	Died July 1902. Sudden cardiac failure; ulcer in descending colon, fistula pumucosa, ileum and sigmoid flexure, glands quiescent, body well nourished.
Two strictures of ileum; intervening long reach of gut healthy; glands.	Resection; double enterectomy ileum; end-to-end union. 18.4.02.	Recovered. Did well till Dec. 1902, when diarrhoea, pain, and emaciation came on; masses of enlarged abdominal glands; improved somewhat on rest and diet.	Died Feb. 1903. Tuberculous ulcers of intestine, caseating glands, pleural adhesions.

F. M. Caird

No.	Name.	Age.	History.	Condition on Admission.
8	Mrs B. . . .	34	9 months; pain right side abdomen, nausea, vomiting, much diarrhoea, black stools; treated for gastric ulcer 17 months ago. Mother died cancer of liver; two children died of tuberculous meningitis.	Emaciated, feverish, intestinal splashing; mass in right iliac region.
9	{ Miss C. B. . . . " 2nd operation	30 ...	Indigestion, slight diarrhoea, colic, and fever; indefinite symptoms for 7 years; piles. Abscess and focal fistula formed at site of operation.	Anæmic; swelling in right iliac area. Fœcal fistula.
10	W. M. . . .	33	11 months' continuous abdominal tenderness, intermittent pain; since September 1902 attacks more severe; constipated. Tuberculous cervical abscess, æt. 3; middle ear disease, æt. 10.	Muscular; tender abdomen; very tender mass left iliac region; borborygmi.
11	Mrs P. . . .	45	2½ years' abdominal pain; intermittent swelling in right iliac region since April; colic; gurgling; bowels rather loose.	Somewhat mobile tender swelling in right iliac region.
12	Mrs K. H. . .	17	9 months' diarrhoea and abdominal pain. Two brothers with tubercle of knee and of ankle.	Delicate, thin; scaphoid abdomen.
13	W. S. . . .	21	18 months; colic, vomiting; local distension right iliac region; borborygmi; constipation; loss of weight.	Thin, scaphoid abdomen, peristalsis, tenderness; gurgling.
14	Miss J. S. . .	38	11 months; vomiting, diarrhoea, emaciation, later constipation, apex of lung dull. Father died of pleurisy.	Emaciated; very weak.
15	Miss T. H. . .	18	Fœcal fistula, which followed after operation for tuberculous retroperitoneal glands in right iliac region. Two brothers have tuberculous cervical glands.	Well nourished; ventral hernia in appendicular area, two fistulæ.
16	Miss R. T. . .	39	18 months; attacks of pain, vomiting, and swelling in right iliac region; constipated.	Thin; right iliac region tender.

Intestinal Tuberculosis

Findings at Operation.	Operation.	Result.	After-History.
Lower end of ileum knotted around the cœcum and appendix; all adherent, forming a mass; strictured ileum; glands.	Resection; ileo-cœcal; end-to-end union. 10.5.02.	Died, 12.5.02. Sectio; purulent fluid in Pouch of Douglas; tuberculous Fallopian tubes; tuberculous mucopus in uterus.	
Stricture almost obliterating ileo-cœcal valve; appendix buried in the mass; glands.	Resection; ileo-cœcal; end-to-end union. 24.10.02.	Recovered.	
Intestines matted and studded with tubercles.	Lateral anastomosis between ileum and colon. 24.5.03.	Recovered.	Died, Dec. 1903. Tuberculous enteritis and peritonitis.
8 inches of ileum and descending colon studded with tubercle, surrounding and adherent to a mass of softened glands, one of which ruptured, discharging foul smelling pus.	Resection of ileum glands and abscess mass; end - to - end union. 17.10.02.	Died, 18.10.02. Patient rapidly sank; sectio; general peritonitis; intestines matted; union intact.	
Colloid cancer of cœcum and tubercle; glands; colloid cancer on remote portion of ileum.	Resection; double enterectomy; ileo-colic and ileum; end - to - end union. 17.9.03.	Died, 25.9.03. Became maniacal; no sectio.	
Ileo-cœcal valve thickened, stenosed; two ulcerating strictures of ileum; adhesions; glands; omentum or net without fat; tubercle of peritoneum.	Enterectomy; ileo-cœcal; 20 inches; end-to-end union. 8.4.04.	Died, 10.4.04. No record of sectio.	
Ileo-cœcal stricture; adhesions; glands.	Enterectomy; ileo-cœcal; 9 inches; end-to-end union. 16.4.04.	Recovered.	1920. Perfect health.
Strictures of ileum and ileo-cœcum; glands.	Resection; double enterectomy; ileo-cœcal and ileum; 14 inches. 12.6.04.	Died, 15.6.04. No sectio.	
Thickened papillomatous cœcum and ascending colon; tuberculous mass and adhesions on cœcal wall; dilatation and hypertrophy of ileum.	Resection; ileo-cœcal. 1.8.04.	Recovered.	In good health several years later; not traced 1920.
Stricture, ileum, close to valve; tubercles on surface of ileum and cœcum; glands.	Resection; ileo-cœcal; 12 inches; glands; end-to-end suture. 6.12.04.	Recovered.	Died, 23.9.06.

F. M. Caird

No.	Name.	Age.	History.	Condition on Admission.
17	G. I. . . .	20	7 weeks ; abdominal pain, vomiting ; resistant right iliac region ; constipation.	Healthy youth ; thought to have appendicitis.
18	Mrs C. H. . .	29	9 months ; pain, vomiting, occasional diarrhoea ; generally constipated ; gastric ulcer, æt. 18.	Anæmic, emaciated ; patterns, borborygmi.
19	Mrs W. . . .	27	8 months ; intermittent colic, vomiting, flatulence, patterns, borborygmi, lung apices old tubercle ; enlarged cervical glands 3 years ago.	Anæmic, emaciated ; right iliac region tender ; intestinal peristalsis ; amenorrhœa since June.
20	Miss A. P. . .	28	2 months ; attacks simulating appendicitis. Since July slight local pain, discomfort ; hernia of scar ; loss of weight and lately diarrhoea.	Slight fulness right iliac region. Hernia at upper end of scar admits tip of finger.
21	Miss T. W. . .	35	6 months ; abdominal and right iliac region pain, vomiting, borborygmi ; loss of weight.	Emaciated ; resistance in right iliac and lumbar regions.
22	J. M. . . .	23	4 months ; pain in lower abdomen.	Fair general health ; tender area below and to right of umbilicus.
23	A. N. . . .	35	1 year ; abdominal pain, vomiting, constipation, eructation, intestinal splashing ; emaciated ; test meal, no free HCl.	Emaciated ; very anæmic.
24	Mrs M. R. . .	28	3 years ; pain, distension, constipation, flatulence, vomiting, patterns.	Thin ; tender areas and distended bowel below umbilicus ; gurgling ; hard midline area.
25	R. S. . . .	47	3 months ago attack of diarrhoea ; seven weeks chronic abdominal pain following acute seizure.	Well nourished ; ill-defined resistant mass size of fist below and to left of umbilicus.

Intestinal Tuberculosis

Findings at Operation.	Operation.	Result.	After-History.
Terminal 6 inches of ileum greatly congested to within $1\frac{1}{2}$ inch of valve; stricture of ileum; glands.	Resection; ileum; 9 inches; end-to-end union. 10.12.04.	Recovered. Local sepsis and fœcal fistula, 17.12.04. Symptoms of intestinal obstruction, laparotomy band divided; small intestine emptied. 18.1.05. Left hospital with fistula. 28.3.05.	Died, spring 1906.
3 strictures of ileum and stricture of valve; glands.	Resection; ileo-cœcal; 15 inches; glands; lateral suture. 1.6.05.	Recovered.	Well, 1910.
Visceral peritoneum with general tuberculosis; seven ulcerating zones, lower portion of ileum; glands.	Lateral anastomosis of ileum to ascending colon. 11.11.05.	Died, 24.11.05. Sæctio; rapid pulmonary phthisis; tuberculous ulceration of intestine.	
Tuberculous cœcal mass involving appendix.	Resection; ileo-cœcal; end-to-end union. 17.3.06.	Recovered.	Died, 15.3.07.
Thickened tuberculous peritoneum; intestines matted, adherent; 1 pint encysted serum in Pouch of Douglas.	Laparotomy; drained. 9.10.06.	Recovered. Reported later very well.	
Stricture of colon 1 inch above ileo-cœcal valve; adhesions; caseating glands.	Resection; ileo-cœcal; glands; lateral union. 14.3.06.	Recovered.	Died, 12.4.18. Good health till 1916; then local pain and formation of fœcal fistula.
Long tight ileo-cœcal strictures, and slighter implication of ileum 1 inch from valve.	Resection; ileo-cœcal; lateral anastomosis. 4.5.06.	Recovered.	Perfect health, 1920.
Strictures of first 16 inches of jejunum; great masses of mesenteric glands.	Gastro-enterectomy anterior. 8.6.06.	Recovered.	Died, 26.7.06. Fever, wasting, hæmatemesis.
11 strictures lower portion of ileum; mesenteric glands in mass affected up to root of jejunum.	Lateral anastomosis; ileum and colon. 22.6.06.	Recovered.	Died, 27.11.06.
Mass of caseating glands, involving ileum and colon, adherent to the parietal peritoneum, which was thickened and showed caseating foci.	Resection; double enterectomy, colon, ileum and glandular mass; end-to-end union. 16.6.06.	Recovered.	Perfect health, 9.6.20.

F. M. Caird

No.	Name.	Age.	History.	Condition on Admission.
26	Miss I. P. . . .	36	3 months; vomiting; flatulence; loss of weight. 7.10.05, pyloro-gastrectomy for large infiltrating carcinoma.	Thin; mesial cicatrix; test meal, no free HCl.
27	Mrs E. C. C. . . .	38	8 months vomiting, diarrhoea; patterns; intestinal splashing; no free HCl. Father died of phthisis. Mother of bronchiectasis.	Thin, tender, mobile; swelling to left of umbilicus.
28	Miss T. M. . . .	22	6 months; intermittent attacks like appendicitis; local tenderness; colic, vomiting, and diarrhoea.	Tender abdomen; resistant iliac region; gurgling.
	„ 2nd operation	...	Return of symptoms Nov. 1909, and again continuing January 1910.	Anæmic; thickening in right iliac region.
29	Mrs B.	32	20 years; abdominal discomfort; last 2 years constant pain; borborygmi, occasional vomiting; bowels occasionally loose, generally constipated.	Thin; retracted abdomen; tenderness and resistance above umbilicus; tender cœcum; peristalsis; gurgling.
30	W. R.	37	10 months; two attacks like appendicitis. Father died of pleurisy.	Nodular resistant mass in right iliac region with variable swelling dating from first attack.
31	A. C. L.	20	3 years ago tuberculous peritonitis with exudate; recovered after 6 months in bed, and Koch's new tuberculin; orchidectomy. Last 4 days sudden abdominal pain and vomiting.	Doughy abdomen; umbilical region tender.
32	G. R.	16	2 years; colic, occasional attacks of diarrhoea, constipation. Tuberculous cervical glands 3 years ago. Father died of phthisis.	Puny, poorly developed; patterns.
33	Mrs C. T.	57	3½ months; intermittent pain, sickness, vomiting; constipated. Lost two children from tubercle.	Thin, distended coils of intestine near right iliac region; borborygmi; splashing.

Intestinal Tuberculosis

Findings at Operation.	Operation.	Result.	After-History.
Stomach, liver, and peritoneum show adhesions; tuberculous strictures lower part of ileum, and trans. colon; superficial tubercles.	Resection; ileo-cæcal; lateral union. 17.11.06.	Recovered.	Not traced.
Tuberculous thickened stenosed area in trans. colon, $1\frac{1}{2}$ inch long to left of mid-line; glands.	Resection; enterectomy; trans. colon; lateral anastomosis with ileum. 4.12.06.	Died, 17.12.06. Sectio; thrombosis pulmonary artery; localised peritonitis. Tubercles of ascending colon; mesenteric and omental glands.	
Three strictures lower portion of ileum; glands.	Resection; ileum, lower 34 inches. 5.4.07.	Recovered.	Died, 1912. Of some abdominal trouble.
Ileo-cæcal mass; hypertrophied ileum; atrophied colon; glands.	Resection; ileo-colic; lateral union. 15.2.10.	Recovered.	
Coils of dilated ileum; two strictures bounding a dilated sac, size of a large stomach; glands enlarged, not caseating.	Resection; ileum; lateral union. Appendectomy, long appendix, two concretions. 10.3.08.	Recovered.	Well, 1910.
Ileo-cæcal mass adherent to posterior wall.	Resection; ileo-cæcal. 10.11.08.	Recovered.	Well, 1910.
Intestines matted, infiltrated with tubercle, friable and easily lacerated.	Resection; double enterectomy; ileum. 28.6.09.	Recovered.	Well, 1920.
Annular stricture of ascending colon one inch above ileo-cæcal valve; glands.	Resection; ileo-cæcal, 6 inches, lateral union. 18.12.09.	Recovered.	Died. Suddenly, 5.6.10.
Ileo-cæcal stricture; two strictures of ileum, the lower arresting several damson stones; glands; tuberculous nodules on the parietal peritoneum.	Resection; ileo-cæcal; 18 inches; end-to-end union; glands. 24.12.09.	Died. Good progress till 30.12.09; collapse; fæcal matter in wound; sectio; union intact but ruptured gangrenous area in colon near union.	

F. M. Caird

No.	Name.	Age.	History.	Condition on Admission.
34	Miss M. M. . . .	31	Fæcal fistula following operation for acute appendicitis, March 1912.	Fæcal fistula; skin barely irritated.
35	Miss F. . . .	16	12 hours' pain right iliac region; vomiting.	Poorly nourished; some resistance right iliac region; no fever; leucocytosis; 6000.
36	S. E. . . .	42	4 years "dyspepsia"; 15.11.15 admitted as case of perforated duodenal ulcer; no rigidity; symptoms passed off; two similar attacks in convalescent hospital. Lost weight last 6 months.	Thin.
37	Mrs C. B. . . .	50	Abdominal pain, intermittent chronic spasms, colic, vomiting since April 1913; prior to this 13 years with abdominal pain; long hospital history; gall-stone removed 31.10.13; glands removed from axilla, October 1901. Child died of tubercle.	Emaciated; abdomen greatly distended; patterns; borborygmi.
38	G. S. . . .	18	3 months' slight pain right iliac region, increasing last 14 days. Mother and sister died of phthisis.	Tender rather fixed appendicular area.
39	Mrs E. W. . . .	23	1 year after confinement followed by pelvic peritonitis; pain, swelling in cæcal region, peristalsis, borborygmi. Sister died of phthisis.	Intestinal splashing; transient swelling in cæcal region subsiding with loud borborygmi.
40	Miss M. F. . . .	23	9 months; pain with occasional swelling in right iliac region; borborygmi, constipation. 5 years ago "ulcerated stomach"; had to exercise care in diet.	Well nourished; abdomen rather rigid on whole of right side; resistant and tender right iliac region.

Intestinal Tuberculosis

Findings at Operation.	Operation.	Result.	After-History.
Matting adhesions ; friable unhealthy ileum; caseating glands.	Resection ; ileo - colic ; end-to-end union. 17.10.13.	Died, 24.10.13. Septic peritonitis ; perforation tuberculous ulcer in jejunum.	
Stricture ; ileo-cæcal and ileum 1 inch from valve ; caseating glands.	Resection ; ileo-cæcal ; lateral union; glands. 15.11.15.	Recovered.	Well, 1920.
Three strictures of ileum, lowest 1½ inch from valve ; glands.	Resection ; ileum ; 30 inches ; end - to - end suture. 10.12.15.	Recovered.	Very good health, 1920.
Strictures of ileum, lowest almost occludes lumen ; atrophied colon ; glands.	Resection ; ileo-colic. 15.2.16.	Died. Anastomosis intact. 17.2.16.	
Ileo-cæcal stricture; glands.	Resection ; ileo-cæcal ; end-to-end union. 29.2.16.	Recovered.	Died, phthisis, 1918.
Strictures, ileo-cæcal and 4 of ileum ; glands.	Resection ; ileo - colic ; 30 inches. 21.4.16.	Died, 24.4.16. Continuous vomiting ; so wound re-opened ; knuckle of bowel adherent slightly to mesenteric wound, no evidence of obstruction.	
Stricture ; ileo-cæcal valve 86 inches higher in ileum both with arrested debris of orange seeds, peel, and husk of date ; glands.	Resection ; ileo-cæcal ; end-to-end union. 6.5.16.	Recovered. Perfect health, 1920.	

F. M. Caird

No.	Name.	Age.	History.	Condition on Admission.
41	Mrs L. . . .	37	1 year; exhaustion and weakness, followed by persistent diarrhœa. Always anæmic.	Wasted; anæmic; abdomen scaphoid; intestinal splashing.
42	Miss M. M. C. . .	38	28 years; monthly attacks of diarrhœa associated with lumbar pain; gastric ulcer 11 years ago.	Emaciated; poor physical and mental development; abdomen scaphoid; tender right iliac region.
43	Miss M. T. . . .	24	10 years; intermittent attacks, melæna; diarrhœa; no pain. Father, mother, and sister died of phthisis.	Anæmic; fairly well developed; doughy cœcal region; no borborygmi, distension, or colic.

Intestinal Tuberculosis

Findings at Operation.	Operation.	Result.	After-History.
Thin-walled ileum with eight ulcers; glands, many calcareous. Probably early active tubercle.	Resection; ileo-colic; lateral anastomosis. 12.3.18.	Recovered.	
Small congested area on ileum 4 inches from termination; four scattered tubercles on serosa.	Laparotomy only. 4.5.18.	Recovered.	Poor health, but no evidence of any tuberculosis, 1920.
Cæcum greatly thickened walls; velvety congested mucosa; lumen of ileum at valve partly occluded by patch of polypoid hyperplastic mucosa; no ulceration; glands.	Resection; ileo-cæcal; lateral anastomosis; glands. 31.5.19.	Died, 2.6.19. Sectio; diffuse colitis; slight congestion, mucosa; calcified nodule left lung apex; union sound.	

CARCINOMA OF THE STOMACH IN A BOY AGED FIFTEEN.¹

By D. A. LAIRD, M.B., Ch.B. (Edin.).

THE occurrence of carcinoma of the stomach in so young a patient as the subject of this note, though extremely rare, is by no means unprecedented. Thus Osler and M'Crae,² in an analysis of 7000 cases, found six between the ages of 10 and 20 years. From the literature they collected thirteen cases between 10 and 20, and six actually below the age of 10.

Hale White,³ writing in Allbutt's *System*, regards some of this last group as more than doubtful. It is interesting to note that one of these was described as congenital (Williamson and Widenhofer), while another was found at autopsy in an infant of five weeks (Collingworth). Hale White³ goes on to say that probably some of the reported cases were sarcomatous, while Hussey, reporting a case of gastric carcinoma in a woman of 26,⁴ mentions that "Fenwick, Osler, and others think it very probable that cases of lymphosarcoma and hypertrophic stenosis of the pylorus were mistaken for carcinoma."

It seems to be agreed that the frequently quoted case of Norman Moore's of carcinoma of the stomach in a girl of 13 is authentic.

Recently Cosens⁵ described a case occurring in a German prisoner of war, aged 18 years and 10 months, and cases in the early twenties have been reported from time to time.

Carcinomata in equally young subjects have been described in many other situations, *e.g.*, in the rectum at the ages of 3 and 10, in the pancreas and uterus at the ages of 2 and 8 respectively, an adenocarcinoma of the breast at 13 in a male, a squamous epithelioma of a burn in a girl of 12, carcinoma of the cæcum at 12, of the sigmoid at 12 and 13. Some, at least, of these seem to be well authenticated.

Hussey, in the article quoted above,⁴ discussing the frequency of gastric carcinoma below the age of 30, gives the following statistics:—

"In a collection of 2604 fatal cases of gastric carcinoma, Fenwick reports 2.5 per cent. under the age of 30; in 882 cases gathered from various London hospitals, based on clinical findings only, 3.4 per cent. Welch, in a collection of 2038, finds 2.8 per cent.; Reiche, in his Hamburg statistics, 0.9 per cent."

Carcinoma of the Stomach

Needless to say, the systematic microscopic examinations of recent years have considerably reduced the percentage of tumours diagnosed as carcinomata.

CASE.—W. H. (male, 15), employed driving a baker's van, was admitted to Ward 23 of the Royal Infirmary, Edinburgh, under the charge of Dr Fleming, on 8th October 1918, complaining of a dull pain over the præcordia and lower part of the left side of the chest, extending round to the back, below the left scapula. This pain had troubled him for a fortnight, but at first was only in evidence at night, after the boy had gone to bed. Throughout the day he, at first, experienced no discomfort, and was able to remain at work. In spite of various homely remedies, the pain increased, and began seriously to interfere with sleep; it was also troublesome by day.

On admission to hospital the boy was seen to be of poor physique. He was 4 feet 10 inches in height and his weight was only 76 lbs. His general development and muscularity were described as poor. He was pale, worried, and anxious-looking, and seemed to be suffering pain. He was slightly cyanosed, but this appearance later passed off.

The previous history showed that he had been in hospital before on two separate occasions, for scarlet fever and for pneumonia. The family medical history was without blemish. Home conditions are said to have been good. As regards food, he professed never to have had a hearty appetite. The main meal of the day he took in the late afternoon, while at mid-day he consumed a number of buns. He gave a definitely negative history of any previous digestive disturbance.

Examination of the abdomen revealed a small epigastric swelling just medial to the left costal margin. This is described as imparting a sensation as of cartilage to the examining hand. There was no tenderness, but a dull pain was complained of over the swelling, and radiating back to the left scapula.

Percussion indicated an enlargement downwards of the liver, and firm pressure elicited tenderness below the right costal margin.

Progress while in Hospital.—In hospital, first on milk, then on light diet, the patient continued to suffer from pain and sleeplessness, for which hypnotics had to be administered. His weight on 11th October was 73 lb., on 18th October 69 $\frac{3}{4}$ lb.

He vomited twice, on 21st and 22nd October, and the vomit contained no free HCl. A test meal also showed absence of free HCl. Unfortunately no further details as to either test meal or vomit are available. An X-ray photograph on 16th October showed nothing of interest. No opaque meal X-ray was taken. A blood count showed a leucocytosis. There is no record of an examination of the stools for blood.

D. A. Laird

On 23rd October the boy was seen by Professor Alexis Thomson, and transferred to Ward 13 for operation. When the abdomen was opened by Professor Thomson on 25th October, an inoperable tumour of the lesser curvature of the stomach—with secondary nodules in the liver—was found. Glands were excised from the mesentery for examination, and the abdomen was closed. After this operation a slight improvement took place. The boy's appetite improved for some days, but he began to go downhill again, and he died on 21st November. Shortly before death vomiting again occurred, the vomit apparently containing altered blood.

Post-mortem Appearances.—The specimen now in the Surgical Laboratory of the University of Edinburgh consists of the stomach and adjacent viscera from this case. The dimensions of the stomach, in the preserved state, are: 15 cm. from fundus to pylorus, and 9 cm. from lesser to greater curvature. A growth involves the whole of the lesser curvature of the stomach and the entire posterior wall medial to the cardiac orifice, reaching as far as the greater curvature. In this extensive area an oval cauliflower-like mass, 9 cm. in transverse, and 6.5 cm. in vertical diameter, stands out prominently and deeply fissured, projecting into the cavity of the stomach, with well-defined upper, lower, and left lateral borders. The mass extends from the medial part of the cardiac orifice along the lesser curvature to the pylorus, this line constituting its upper border, and bulges laterally under the cardiac opening. The lower border of the mass gives place to a considerably thickened and indurated posterior wall of the stomach, this appearance being carried down as far as the greater curvature and to the right so as to reach, but not include, the pylorus.

From the lesser curvature and in contact posteriorly, and to the left with the main tumour mass, is a large oval perforation of the anterior wall of the stomach, 5 cm. by 2.5 cm., whose long axis is directed forwards and to the right.

Posteriorly, the stomach is firmly adherent to the pancreas.

The glands along the greater curvature are enlarged and indurated. The lymph-glands in connection with the lesser curvature have not been preserved in the specimen, but the report on the autopsy mentions that para-aortic and pelvic glands were extensively involved.

Liver.—The maximum vertical length of the liver is, in the preserved specimen, 16 cm., its maximum transverse length 18.7 cm. Scattered over the surface are numerous pale nodules of growth, some of which are umbilicated, varying from the size of small shot to that of a walnut. The central part of the visceral aspect of the left lobe of the liver shows an oval ulcer, 5 cm. by 2.5 cm., with long axis running inwards and forwards, from the left, involving the gastric impression and the tuber omentale. This clearly corresponds to the perforation

Carcinoma of the Stomach

of the anterior wall of the stomach already mentioned, and must have formed the base of a malignant ulcer after complete destruction of the adherent stomach wall. The gall bladder is normal.

A small portion of the *diaphragm* removed from around the œsophageal opening shows several pea-like nodules on both thoracic and abdominal aspects.

Pancreas.—Scattered over the head of the pancreas are numerous nodules the size of a pea. Anteriorly the body of this organ and the neck and medial portion of the head are firmly adherent to the adjacent structures.

Just below the duodeno-jejunal flexure are some enlarged mesenteric glands. On section they are found to be calcareous.

The *spleen* shows no abnormality.

The post-mortem report indicates that perforation of the stomach occurred shortly before death, for the peritoneal cavity contained gastric contents but showed no signs of inflammatory reaction. The report further mentions that the lungs were congested and that glands in the posterior mediastinum and round the arch of the aorta were infected with cancer.

Microscopical Appearances.—1. *Stomach*.—Examination of sections from the edge of the main tumour mass shows the stomach wall to be invaded with a growth of the nature of a columnar epithelioma, spreading successively from the mucosa, both directly and by lymphatic channels, to all the coats. Of the tumour cells some occur singly, some in clumps of varying size, while many have a definite glandular arrangement. The stroma is moderate in amount. Many of the gland-spaces show the formation of colloid material. The mucosa is densely packed with leucocytes.

2. *Liver*.—Sections from the margin of a secondary nodule in the liver shows this organ to be involved in the malignant process mainly by portal spread. The smaller portal branches are loaded with tumour cells. The intervening liver tissue is scanty, and is compressed and distorted by the advancing growth. Here and there islands of enlarged and hypertrophied liver cells are found. Colloid formation is again present, but the glandular arrangement of cells is not so evident as in the stomach.

3. *Head of Pancreas*.—There is no sign of invasion of the acini of this gland. Some of the islets of Langerhans show cellular necrosis. The connective tissue stroma is extensively invaded, the lymphatics being filled with carcinomatous emboli.

4. *Lymph-Glands from Greater Curvature of Stomach*.—The normal structure has almost entirely disappeared, being replaced by tumour tissue. This is arranged in columns of cells lying in a

moderately plentiful stroma, and having little of the glandular arrangement seen in the stomach.

5. *Nodule from the Thoracic Aspect of the Diaphragm.*—Here again are columns of epithelial cells showing little evidence of their glandular origin. Lymphatic vessels on both aspects of the muscle contain cancerous emboli. There is no actual involvement of the muscular fibres. The nodule lies in their connective-tissue covering. Deposits of growth extend down between the bundles of muscular fibres.

Summary.

Here, then, is the case of a boy, 15 years of age, without suggestive hereditary or personal medical history, whose complaint is of pain of a fortnight's duration, with occasional vomiting, the nature of which, and whose relation to the taking of food, have not been specified.

There is a palpable epigastric tumour. The liver is enlarged. There is leucocytosis. Both test meal and vomit show absence of free HCl. There is no X-ray evidence of value. There is no record of testing the stools for blood. Progressive and rapid loss of weight occurs.

Laparotomy is performed and an inoperable growth found. This is followed by a temporary improvement, subsequent progress of the disease terminating in death.

Microscopical examination shows a columnar-celled carcinoma of the lesser curvature of the stomach with extensive metastases to lymphatic glands—gastric, pyloric, aortic, mediastinal—to the liver, the pancreas, and the diaphragm.

Certain features call for further comment.

The Sex of the patient is noteworthy. In the report quoted above,⁴ Hussey mentions that Fenwick, in a collection of twenty-five cases of gastric carcinoma before the age of 30, found males more frequently attacked than females in the ratio of five to one. All the six cases reported by Osler and M'Crae,² were in males. Hussey's own case was in a woman of 26, Moore's case in a girl of 13. Whether the same peculiarity of sex-incidence applies to carcinomata in other parts of the body is worth considering.

Eastman,⁶ reporting a case of carcinoma of the cæcum in a girl of 23, mentions carcinomata of the sigmoid described by Garrod and Czany respectively, in girls of 12 and 13. These, together with the cases already mentioned of carcinoma uteri at 8, and burn-epithelioma in a girl of 12, if they indicate any-

Carcinoma of the Stomach

thing, would seem to show that this age-sex-incidence may not be so marked in other situations as in the stomach.

Most writers are agreed that carcinomata in young subjects usually run a dramatically rapid course. In this case only two months elapsed between the first symptom and death, and metastasis had apparently occurred when the patient was admitted to hospital, only a fortnight after his first symptom. Cosen's case lived little more than a month after his first reporting sick, while Hussey's lived only a little longer.

It is said to be characteristic of inoperable carcinomata of the stomach that the patient may show a temporary improvement after laparotomy. This was borne out in this case.

The metastatic involvement of the diaphragm is unusual. Symmers, in an analysis of 298 malignant growths,⁷ found metastasis in 70 per cent. Among these only three showed invasion of skeletal muscle, of the diaphragm only one. Here, as already mentioned, the carcinomatous invasion was limited to the connective-tissue between the bundles of muscular fibres.

It will be remembered that the cancer stopped short at the cardiac orifice of the stomach. Œsophageal cancers frequently spread to the stomach, but the converse does not, as a rule, take place.

My thanks are due to Professor Alexis Thomson and to Dr Fleming for kind permission to publish this case.

REFERENCES.—¹ From the Surgical Laboratory, the University of Edinburgh. ² Osler and M'Crae, *System of Medicine*, 1909, vol. v., pp. 220 *et seq.* ³ Allbutt and Rolleston, *System of Medicine*, 1907, vol. iii., p. 495. ⁴ Hussey, R. G., "Gastric Carcinoma in a Woman of 26 Years," *Johns Hopkins Hosp. Reports*, Balt., 1916, xviii., pp. 81-85. ⁵ Cosens, W. B., *Brit. Med. Journ.*, 1917, i., p. 649. ⁶ Eastman, J. R., "A Case of Carcinoma of the Cæcum in a Girl 23 Years of Age," *Am. Journ. Obstet.*, New York, 1916, lxxiv., pp. 380-86. ⁷ Symmers, D., "The Metastasis of Tumours, etc.," *Am. Journ. Med. Sc.*, Philadelphia, 1917, cliv., pp. 225-40.

TWO CASES OF RENAL DECAPSULATION IN SUBACUTE DIFFUSED NEPHRITIS.

By FRANCIS D. BOYD, M.D.

THE priority in the suggestion of the surgical treatment of nephritis may indeed be disputed, but it is certainly since Harrison, in 1896, advocated incision of the kidneys in cases where there was evidence of increased tension of the organ, that much attention has been given to the subject.

In America Edebohls has been the principal advocate of decapsulation of the kidneys for chronic disease. At first, operating to correct a mal-position of the kidney, Edebohls concluded that when the mal-position was accompanied by chronic inflammatory changes, decapsulation produced markedly beneficial results. He advocated the view that removal of the capsule is followed by the formation, on the most extensive scale, of new vascular connections between the kidney and its fatty capsule, the removal of the inflammatory products by absorption, and the new formation of epithelium capable of carrying on the functions of secretion—in other words, improvement and restoration of the health of the kidney—are the direct result of this increased blood supply and improved circulation.

Edebohls published the results of 72 cases. In these 7 deaths were immediately subsequent to operation. There were 22 deaths which could not be directly attributed to operation, and of these, 13 died from chronic nephritis or its complications. The remainder appeared to improve as the result of operation. Of these 9 died from other causes; 3 are classified as unimproved, but the patients themselves were abundantly satisfied with the results of operation; 20 patients experienced decided improvement in general health, and in the condition of the urine, as a result of operation; 17 are classified as being cured of chronic nephritis, 10 being cases of chronic interstitial nephritis; in 3 cases the results of operation could not be ascertained. One may not always agree with the author in his diagnosis, but the results are certainly striking.

Other cases of decapsulation for nephritis are published by Primrose, Tyson, Cabot, Elliott, Lyman, Guitéras, Hanchet, Israel, Pousson, Caillé, Nydegger, Wille, the writer, and others.

Renal Decapsulation in Subacute Nephritis

The following two cases have recently been under observation and show points of interest :—

CASE I.—A miner, aged 41, was admitted to the Royal Infirmary on 2nd September 1916 complaining of swelling of the legs and abdomen, and of breathlessness. Nine months previously the patient, while at his work, was troubled with pain in the back. The pain was only present when he was actually working and did not trouble him while he was at rest. About this time the patient became conscious of a difficulty in getting out of bed in the mornings. He became more easily tired than usual and began to suffer from severe headaches. The pain in his back gradually became more severe and the headaches much worse, and he had to give up his work a fortnight before admission. Three weeks before admission he noticed that his eyes, face, and ankles were swollen. This was followed by swelling of the abdomen and legs.

The patient had always been a strong man. His home surroundings had been very satisfactory. He had worked in the pit all his life. He had been very temperate and a very light smoker. On examination, a well-developed, muscular man. Both legs were found enormously swollen and the abdomen very much distended with free fluid. For some weeks before admission patient had suffered from frequency of micturition, having frequently to get up at night so that his rest was disturbed.

Urine.—Colour: amber. Quantity: on an average, 20 oz. per diem. Specific gravity: 1023. Albumin: 32 grs. to the ounce. No sugar. Numerous hyaline and granular casts present. The phthalein excretion stood at 28.

The circulatory system showed considerable cardiac dilatation. The heart sounds were weak—the first mitral impure, the second pulmonary slightly accentuated. The radial vessel showed very faint thickening. Systolic blood pressure: 130.

Headache was a pronounced feature, but the fundus oculi showed no changes.

The blood showed mild secondary anæmia. The soluble nitrogen of the blood stood at 60 mg. per 100 c.c. of blood.

Treatment was begun by tapping the abdomen and placing the patient on a nitrogen-free diet. No improvement followed, the urinary quantity remaining low and the fluid reaccumulated. Salt-free diet was exhibited, combined with the administration of digitalis, but the urinary quantity failed to rise. Dry diets similarly failed to produce any benefit, the patient remaining completely water-logged.

Between September and January 119 pints of fluid were evacuated from the abdomen and 13 pints from the legs. Diuretics were tried, but had no apparent influence on the secretion of urine. Cardio-

Francis D. Boyd

vascular changes were becoming very pronounced, and these, combined with œdema of the lung, were giving rise to considerable dyspnœa. It was obvious that something must be done if the patient was to obtain relief. The patient was very conscious of his critical condition and gladly accepted the suggestion of operative treatment. Accordingly, Sir David Wallace carried out decapsulation of the kidneys. The organs were large and firm. An incision was made into the capsule, along its diameter, and the capsule stripped from both sides of the kidney. Very little urine was excreted on the day of operation, but the following day the patient passed 55 oz.; 70 oz. on the third and fourth; and thereafter averaged 70 to 80 oz., until œdema had disappeared. Ten days after the operation the albumin quantity had fallen to 2.2 grs. per ounce. Progress was uninterrupted until the patient was discharged on 3rd February. He was then going about. Towards evening there would be some slight œdema of the ankles. The urinary quantity was about 50 oz.; the albumin 1.2 per cent. After a short period at home the patient returned to work, getting a light job on the surface. When last heard from, a month ago, he had been working uninterruptedly for three years. There was still albumin present in the urine, but the circulation was satisfactory and the patient expressed himself as feeling well.

CASE II. was admitted to the Royal Infirmary on 14th July 1919 complaining of pain in the right lumbar region and swelling of the eyes and face. Eight days before admission the patient had had to stop work on account of pain in the lower part of the abdomen. At the same time he noticed that his face and eyes were swollen. He stated that he was passing an ordinary amount of urine, but that it was dark in colour and micturition was accompanied by pain. As there appeared to be no improvement in his condition under treatment at home he sought admission to the Infirmary.

Patient's home surroundings had always been satisfactory, and there was no history of any previous illness save measles at the age of thirteen.

On examination the patient, a well-developed lad, was found to be very drowsy and apathetic. His face, eyes, and legs were swollen and the skin was very dry. The urinary quantity was greatly diminished and it contained albumin—17.5 grs. to the ounce—blood, and an enormous number of casts—epithelial, granular, hyaline, and blood. The cardio-vascular system showed no changes. The blood pressure was low—systolic, 79; diastolic, 55. The blood showed a mild type of secondary anæmia. The soluble nitrogen of the blood was increased (59 mg. per 100 c.c.). The phenolsulphophthalein excretion stood at 28.

At first the patient appeared to improve under treatment, but

Renal Decapsulation in Subacute Nephritis

improvement was transitory. By the end of six weeks œdema and ascites had become very massive and repeated tapplings had to be undertaken, and Southey's tubes introduced into the legs. In all, 62 pints of fluid were evacuated in this way.

By October the patient had become definitely uræmic. Headache was marked, and serious convulsive phenomena developed accompanied by a very definite rise in the soluble nitrogen of the blood. It was obvious that unless something were done a fatal termination was imminent. After consultation with Sir David Wallace it was decided to perform renal decapsulation.

On exposing the kidneys the organs were found to be large and deeply congested. The capsule was incised longitudinally along the convex surface of the organ and stripped. The kidneys were returned and the wound closed. The following day the patient's condition gave rise to some anxiety as little or no urine was secreted, but on the second day 20 oz. were passed; the third day, 40; the fourth day, 80; on the fifth day, 120; and diuresis continued until the œdema had almost completely disappeared. Convalescence was uninterrupted. Now, five months after operation, the patient is enjoying apparent good health. Albumin is absent from the urine, though it is obvious that the patient will still require to exercise care as the phthalein excretion is still low (51 per cent.), if this can be taken as any true estimate of renal function.

To treat chronic interstitial or parenchymatous nephritis by any method which will improve the circulation through the kidney is, theoretically, eminently desirable. In chronic interstitial nephritis, the adhesion of the capsule of the kidney has been ascribed to an effort on the part of nature to vascularise the kidney, new vessels passing into the cortex and aiding the maintenance of the circulation through the kidney.

Will decapsulation result in improved circulation through the kidney? Edebohls contends that it will, basing his contention on the observation that when he operated a second time on kidneys where nephropexy and partial decapsulation had previously been performed, he found extensive and very vascular adhesions, adhesions so vascular as to give considerable difficulty from hæmorrhage at the time of the second operation.

Claude and Balthazard, Albarran and Bernard, have investigated the effects of decapsulation performed experimentally on healthy rabbits. Johnson, working with dogs, decapsulated the kidneys and examined them histologically at varying intervals after operation. The dogs all remained healthy, a new capsule gradually formed, sometimes thinner, but more

Francis D. Boyd

often thicker, than the original. There was sometimes an infiltration of round cells, and a proliferation of the intertubular connective tissue of the kidney, but in no case did the observer find any considerable anastomosis between the renal and perirenal vessels.

Ferrarini, on the other hand, found an abundant new vascularisation, and gives illustrations showing the connection between the vessels of the kidney on the one hand and those of the surrounding structures on the other.

Other observers, such as Hall and Herxheimer, have produced acute nephritis in animals. Decapsulation was then performed. They found that a new capsule formed, new vessels were found in the tissues surrounding the kidneys, but were separated from the cortex by the newly formed capsule. Strands of newly formed tissue passed into the cortex and contained newly formed vessels, but these vessels were not large enough to contain elastic fibres. There was no evidence that the capillaries which passed into the cortex were more numerous than normal.

So far there have been very few post-mortem results reported on the human subject as regards the effects of decapsulation on the circulation of the organ.

Jewett reports a case, and states that in neither kidney was there any newly formed blood supply through adhesions. Edebohls reports a case which was examined by Larkin, and states that Larkin was able to establish clearly the existence of an abundant vascularisation of the new capsules, of direct connection between the vessels of the new capsule and those of the perinephritic fat, and of direct penetration of the newly formed vessels of the new capsule, along connective tissue paths into the substance of the kidney, thus affording corroboration of his view of a new and increased blood supply to the kidney after decapsulation.

The writer, along with Beattie, published a clinical and pathological report on one case where death took place a considerable period after decapsulation. Sections of the kidney showed the formation of definite new fibrous capsule. There were fibrous prolongations from the capsule into the kidney substance, some of these being cellular, the cells being wholly of the small mononucleated type. This capsule was extremely vascular and many of the vessels widely dilated. At places there was distinct anastomosis between the cortical and capsular vessels.

Renal Decapsulation in Subacute Nephritis

A section from the dorsal aspect of the kidney, with the perinephritic tissues, showed that these tissues were *firmly* adherent to the kidney, and it was not possible to make out any boundary line between them and the capsule of the kidney. The part adjacent to the kidney was, in the main, composed of dense fibrous tissue. In places, however, there were large cellular foci spreading into the kidney substance. In the outer part of the thickened capsule there were remains of kidney tubules, showing conclusively that the deeper layer (*i.e.*, between the kidney substance and the separated tubules), though dense, was a newly formed capsule. This new capsule was very vascular, and at places there were large vessels which seemed to anastomose with vessels in the superficial part of the cortex of the kidney. At places there was a very distinct formation of new fibrous tissue, external to the capsule, or at any rate, to a layer of the capsule which was adherent to the kidney. This new fibrous tissue was invading and obliterating the fat cells in the perinephritic tissue. This new tissue was very vascular.

In this case, then, decapsulation was followed by the formation of a dense new capsule. This new capsule, though dense, was vascular, and contained vessels which appeared to anastomose with the vessels in the superficial part of the cortex of the kidney; but it is doubtful whether the formation of these new vessels could more than compensate for the normal communication between the renal and perirenal vessels which was ruptured by the operation of decapsulation. The new capsule formation was accompanied by a prolongation of new fibrous tissue in the cortex of the kidney. The interstitial changes existing before decapsulation were thus accentuated.

From the clinical standpoint, is decapsulation of the kidneys an operation from which benefit may justly be expected? That it is followed by a marked diuresis and a subsequent diminution in the excretion of albumin and a rise in urea excretion there can be no doubt. The diuresis cannot be ascribed to the formation of a new vascular supply as the onset is, as a rule, within forty-eight hours of operation. In cases of subacute diffused nephritis one is dealing with a swollen congested organ, the circulation through which is impeded by tension due to the capsule. Operation will relieve the circulation through the organ by relieving tension, and diuresis may result from the improved mechanical conditions under which the blood is circulating in the organ.

Francis D. Boyd

It is not for a moment claimed that decapsulation is the ideal treatment for subacute diffused nephritis. The writer realises that in many cases of subacute diffused nephritis improvement takes place after a long period of illness, and it is, at times, difficult to say on what factor improvement depended. All that is contended is that there are cases of subacute diffused nephritis where the patient is obviously going downhill and where death may be expected to occur from uræmia in a very limited period of time. When, in such a case, the soluble nitrogen of the blood rises above 100 mg. per 100 c.c. death may be expected within a period, certainly of weeks, possibly of days. In such cases it seems desirable that any method should be tried which may promise the slightest chance of ameliorating the patient's condition. Decapsulation, in those cases, will usually result in a diuresis, which diuresis may produce definite improvement in the patient's condition, as shown by diminished oedema and a fall in the soluble nitrogen of the blood.

Is decapsulation the operation of election? It seems doubtful on pathological grounds whether simple incision would not be preferable.

Incision of the kidney may be expected to do good in acute nephritis, when there is evidence of kidney tension with anuria. In chronic parenchymatous nephritis incision of the kidney may be expected to produce a diuresis when other measures have failed. A diuresis at a critical time in the disease may tide the patient over an anxious period, and may permit of improvement taking place. Neither decapsulation nor incision of the kidneys can be expected to cure chronic interstitial nephritis, nor the *pathological* conditions upon which the kidney changes depend. In chronic interstitial nephritis the renal changes are but a part of the general condition. Incision or decapsulation may relieve symptoms for the time being; it is not reasonable to expect it to cure the disease. It seems very doubtful if it should even be undertaken.

CLINICAL RECORDS

THREE CASES OF DECAPSULATION OF THE KIDNEY FOR CHRONIC NEPHRITIS.

By J. S. FOWLER.

THE following cases show the markedly beneficial results of Edebohl's operation of decapsulation of the kidney in relieving the urgent symptoms of chronic parenchymatous nephritis :—

CASE I.—William E., aged 7, admitted to the Sick Children's Hospital, 9th May 1919. Complaint—"Kidney trouble." Was a healthy baby, and has always thrived well. Scarlet fever at 5 years ; said to have made a good recovery. Bad attack of influenza six months before the present illness declared itself. Family history unimportant. *Present Illness*—A week before admission the face became puffy, and it was noticed that he was passing less urine than usual. Apart from this he did not seem ill.

On Admission—Moderate degree of œdema of face and ankles ; urine, 8 oz. per diem ; albumin 1.5 grammes per litre ; no blood, many granular casts. Blood-pressure, 125 systolic, 85 diastolic. Weight 33 lb. Other systems negative. Under ordinary treatment (restricted diet, packs, salines, etc.) he rapidly improved, and on 22nd May there was no visible œdema ; he passed 40 oz. of urine free from albumin, and had lost about 4 lb. in weight. Blood-pressure, 107 systolic, 70 diastolic. The improvement, however, was only temporary. The urine fell to 4 oz. on the 24th May, and albumin and casts reappeared. From that date on his condition went from bad to worse. He became completely water-logged, and by September he was unable to move in his bed unaided. Salt-free diet, protein rich diet, hot packs, pilocarpine injections, and all manner of diuretics had been tried without appreciable effect, and fluid accumulated so quickly that Southey's tubes gave very little relief. On the 17th September, notwithstanding that he looked so critically ill, he was transferred to the surgical wards for decapsulation, his weight being 70 lb., as compared with 33 when he was free from œdema. There was evidence of fluid in all the serous cavities ; the skin of the legs was red and cracking. He was passing only a few ounces of urine containing 10 per mille of albumin. Chlorides, 4 grammes in the twenty-four hours.

On 18th September Mr Fraser stripped the right kidney. The child stood the operation remarkably well. On the succeeding day he passed 35 oz. of urine, and a free diuresis set in. On the seventh day

J. S. Fowler

he passed 93, on the eighth day 146, on the ninth day 157, and on the tenth day 91 oz., and concomitantly therewith the dropsy slowly disappeared; four weeks after the operation he weighed only 38 lb.—a loss of 32 lb.—of fluid. He continued well, and was discharged from hospital free from symptoms on 30th November 1919. The urine, however, contained 0.5 gramme of albumin per litre and many casts. This satisfactory progress has continued. When last seen in May 1920 he was well, except for slight puffiness about the eyes. Dr Salt reports (10th November 1920) that the child is doing well, and getting out and about regularly.

CASE II.—Sarah S., aged 56, admitted to Chalmers' Hospital, 26th January 1920. Complaint—Swelling of feet, legs, and abdomen; headache; breathlessness. Has always had good health except for measles and scarlet fever in childhood. She is a domestic servant and has always worked fairly hard until the onset of present illness in the early part of December 1919. The first symptom noticed was swelling of the ankles which steadily increased and spread up the legs. About the same time she began to suffer from very bad headache, which gradually became more persistent so that by the end of December she had to take to bed. By this time the abdomen had begun to swell, and she noticed that she was passing very little water. About a fortnight before admission she was suddenly seized by an attack of severe breathlessness, and this has continued more or less ever since; the headaches, also, have become worse.

On Admission—Patient shows the characteristic appearance of chronic nephritis with general anasarca and ascites. Weight 10 st. 10 lb. Heart healthy, vessel walls not unduly thickened; pulse 70; systolic blood-pressure 130. Lungs, signs of œdema at both bases. Fundi normal. Urine, 16 oz. per diem, loaded with albumin and containing many granular, cellular, and hyaline casts. No blood. Chlorides, 12 grammes; urea, 17 grammes in the twenty-four hours.

The patient was treated at first by milk diet, then by a strict salt-free diet; she had daily hot packs, saline purgatives, various diuretics, and pilocarpin, without the slightest benefit. The urinary output remained low and the dropsy steadily progressed, until, after she had been in hospital for a month, she was absolutely water-logged and could scarcely move in bed. The question of decapsulation was under consideration when on 24th February her temperature rose and she developed a sharp attack of pleurisy all over her left lung. For a day or two she was so critically ill that operation seemed out of the question; she was in constant pain both from intense headache and the pleurisy, and was extremely dyspnoëic and required morphia daily. On 4th March, however, the pleurisy having begun to subside, Mr Beesly stripped the right kidney. She was at that time passing

Decapsulation of the Kidney

about 20 oz. of highly albuminous urine daily. She stood the operation very well, and even the next day expressed herself as being relieved as regards the dropsy of the trunk by the free discharge of serum from the wound in the loin. The stitches were removed on the tenth day, and the wound was practically healed on the twentieth day. There was no marked change in her general condition until the thirteenth day after operation, when the output of urine rose to 77 oz. Diuresis, once established, continued uninterruptedly at the rate of about 100 oz. per day, while *pari passu* the anasarca subsided and had practically disappeared four weeks after decapsulation. A rise of temperature, presumably due to absorption from the wound surface, from the eighth to the eighteenth day, did not retard her progress. Her weight on 25th April was 7 st. 2 lb., a loss of 50 lb. since admission. She was discharged from hospital on 22nd May, feeling well, and free from all symptoms. Her urine was normal in amount, but contained about 0.5 gramme of albumin to the litre, and a number of casts.

She now (18th November 1920) reports that she is better than she has been for years, and is back at her work as a housemaid; she seldom has any headache, and is taking ordinary food well.

CASE III.—Barbara R., aged 10, admitted to Sick Children's Hospital, 11th December 1919. Complaint—Swelling of face. Eleventh and youngest child; all rest healthy except one who died in infancy. Previous health good; no illnesses except measles at one year. Ten days before admission the mother noticed that the child's face was swollen under the eyes, but she did not complain and went to school as usual. She was seen by Dr Hill Buchan on the 10th, and sent to hospital.

On Admission—Weight 41 lb. 10 oz.; some puffiness about the face and ankles and a little free fluid in the abdomen. Heart and lungs normal. Systolic blood-pressure 90. Urine 6 oz. per diem, containing 1.6 per mille of albumin, some casts, no blood. She thus presented all the appearance of a mild case of nephritis, and was treated in the usual way by restricting the diet, packing, and so on. She made good progress for a time, and from the 17th to the 22nd December she passed from 20 to 30 oz. of urine daily, the albumin disappeared, and her weight fell to 34 lb. On the 23rd December, however, albumin reappeared, and the output of urine fell, and her progress for the next five months was that of an ordinary case of chronic nephritis which is getting worse. Though the œdema fluctuated a great deal, and never reached the stage of complete water-logging, it never disappeared entirely, and her weight ranged from 36 lb. when there was little visible œdema, and 46 lb. when she was markedly anasarcaous. As no real benefit was following medical treat-

ment, and as the child was permanently confined to bed by the urgency of the symptoms, it was thought advisable to have the kidney stripped. The operation was accordingly performed by Mr Fraser on 6th May, with an immediately satisfactory result in the shape of diuresis and disappearance of dropsy. She was sent back to the medical side on 6th June, and from that date until her discharge on the 19th she was quite free from symptoms, and passing 20 to 30 oz. of urine daily, with 1.7 per mille of albumin and a few casts. She has been seen several times since leaving hospital, and continues well. Dr Hill Buchan reports (22nd November 1920) that the child is able to go about as usual, but that the urine contains a small quantity of albumin.

COMMENTARY.—I. The indications for the operation of decapsulation are fairly well shown in these three cases, which all belong to the group of chronic parenchymatous nephritis with œdema as the main symptom. This is the form of Bright's disease in which decapsulation has given the best results. Cases of chronic interstitial nephritis do not appear, on the whole, to benefit much from the operation. Decapsulation of one kidney produces only a symptomatic cure, and does not abolish the albuminuria.

2. The operation is not in itself dangerous to life, and patients stand it much better than might *a priori* be expected. Case II. is a good example of this; her condition immediately before operation was so critical that the operation was postponed from day to day lest she should die on the table, and had it not been for the previous experience of Case I., who was almost as ill, I should have hesitated to recommend operation. One could hardly imagine a patient less likely, apparently, to survive a major operation under a general anæsthetic.

3. Decapsulation of one kidney appears to give sufficient relief to the symptoms, and would therefore seem preferable to a double operation at one sitting.

4. The operation ought to be considered in all bad cases if reasonably prolonged medical treatment is producing no betterment. This applies especially to children, because in them there is a much greater probability of ultimate recovery from chronic nephritis than in later life, and thus operation is more than justified as a means of tiding the patient over a critical period.

5. The very rapid improvement which usually follows decapsulation, as illustrated in Cases I. and II., suggests that it may act by relieving the œdema of the kidney. In his work on dechlorination Widal suggested that in these cases there is

Chronic Nephritis in Children

probably a vicious circle, the œdema which affects the kidney in common with all the other organs as a result of the renal inefficiency being in itself still further detrimental to the function of the organ. He believed that dechlorination in the first place broke this link in the circle, and the same may apply to decapsulation.

FOUR CASES OF CHRONIC NEPHRITIS IN CHILDREN TREATED BY DECAPSULATION.

By J. W. SIMPSON.

THE following cases are reported as illustrative of the beneficial results of the operation of decapsulation of the kidney in the chronic nephritis of childhood :—

CASE I.—Boy, aged 9 years. First seen in Out-patient Department suffering from acute nephritis. As he had peeling of hands he was sent direct to Colinton Fever Hospital for observation. He was discharged from Colinton two months later, and on 8th August 1914 he was admitted to the Sick Children's Hospital.

On examination he had slight œdema of face and legs. Urine showed trace of albumin with casts (hyaline and granular). Under treatment he improved somewhat and was sent home on 28th October. Urine still had slight trace of albumin.

He was readmitted on 27th January 1915 with an acute exacerbation of kidney condition. Face became very puffy and there was great diminution in amount of urine passed. The urine on examination was found to be loaded with albumin, and numerous granular and epithelial casts were present. He had a fit shortly after admission. Under further treatment he again improved, but the albuminuria persisted. He was discharged on 9th March 1915. He remained fairly well for about seven weeks, but on 4th May he was readmitted, to be discharged again in July, slightly improved. This improvement did not last long, however, and he was taken into the ward again on 17th August. This time the patient did not respond to treatment; he was very œdematous, with large quantity of free fluid in abdomen, and passing only 3 or 4 oz. of urine. As ordinary medical means had failed it was decided to try decapsulation of kidneys. This was performed by Sir Harold Stiles on 21st September. Boy stood operation well, and within forty-eight hours there was marked improvement in his condition in that much more urine was being passed. On 30th September boy passed 29 oz. of urine and œdema was much less.

J. W. Simpson

From having been very dull and apathetic he became much brighter. He went on steadily improving after this, and on 28th October he was discharged with only the slightest trace of albumin and no casts in the urine. The family went to Australia three months later.

The patient continued in good health for four years. Four months ago he developed some acute infectious condition and died after ten days' illness.

CASE II.—Girl, aged 4 years. Admitted to the Sick Children's Hospital on 19th March 1918 with well-marked nephritis, œdema, large amount of albumin in urine, and many granular, epithelial, and hyaline casts.

She had been under treatment at home for five months, and after treatment in hospital for one month, was discharged improved, with slight albuminuria and a few casts. She was admitted three weeks later on account of a bad relapse. She was medically treated for two weeks, but as there was no improvement Mr Fraser decapsulated one kidney. Three days after operation there was marked increase in the amount of urine passed. This improvement continued, and patient was discharged three weeks afterwards without any trace of albumin.

Patient continued well for ten months. She then developed influenza with pneumonia, and died after three days' illness.

CASE III. (Case II. of Mr Fraser's series).—Girl, aged 9 years admitted to Sick Children's Hospital, 9th December 1918. Patient had been confined to bed for four months previous to admission, suffering from nephritis. On admission the urine was found to contain a fair amount of albumin and a large quantity of blood and with blood and epithelial casts. She was very œdematous. The patient was kept in ward for two months. Her condition had improved somewhat; the œdema was less as also the albuminuria, but the urine still contained a large quantity of blood. It was decided to try decapsulation, and this was done by Mr Fraser. She was discharged one month later much improved. There was a slight trace of albumin present with a little blood. She has got on well since, having attended school all last summer.

Every now and again, however, she has slight hæmaturia, and has to be kept in bed for a week or ten days. During the last three months there has been no trace of blood. The last examination of urine done ten days ago shows very slight trace of albumin with a few red blood corpuscles present in urine. No casts.

CASE IV. (Case I. of Mr Fraser's series).—Boy, aged 9 years. Admitted 29th December 1919. History of three weeks' illness before admission. On examination marked œdema with a good deal of ascites. Large amount of albumin present in urine with blood and casts.

Capsule-Stripping for Subacute Nephritis

Under treatment improved but œdema still persisted, addition of adrenalin to previous treatment caused rapid disappearance of œdema. Sent home to be under care of doctor. Slight trace of albumin still present.

Readmitted 9th June 1920 with an acute exacerbation. Treated for one month medically, but improved very slowly.

Decapsulation of one kidney performed by Mr Fraser in July. Improvement marked after the fourth day, but still some œdema remained with a little albumin; other kidney decapsulated at end of July. Three days afterwards œdema had all disappeared. Child was kept in ward for two months afterwards. During the last three weeks of his stay he was up and about like an ordinary healthy child. He was discharged from ward with urine free from albumin.

CAPSULE-STRIPPING OPERATION FOR SUBACUTE NEPHRITIS.

By JOHN FRASER, F.R.C.S.

CASE I. (Case IV. of Dr Simpson's series).—D. G. (male), aged 9 years. Transferred from medical wards on 15th June 1920, where he had been under the care of Dr Simpson. Albuminuria and persistent œdema had failed to improve under medical treatment.

The right kidney was exposed and the capsule stripped. The stripped capsule was kept in a stripped position by stitches.

Post-operative History.—Five days after the operation the œdema had left the face; a trace still persisted around the ankles. The child's general condition was satisfactory. The stitches were removed on the tenth day. On the fourteenth day the child was returned to the medical ward. By this time all trace of body œdema had disappeared.

The post-operative albumin history while in the surgical ward was as follows:—

Date.	Albumin. Per Mille.	Quantity. Oz.
June 18 . . .	4	12
„ 19 . . .	6	13
„ 20 . . .	1	17
„ 21 . . .	·75	20
„ 22 . . .	1	32
„ 23 . . .	1	34
„ 24 . . .	·75	40
„ 25 . . .	·25	35
„ 26 . . .	0	31
„ 27 . . .	0	32
„ 28 . . .	0	40

John Fraser

Readmission.—The child was readmitted to the surgical wards on 2nd September of the same year, the albumin having reappeared in the urine. On the day after admission the capsule of the left kidney was stripped. The post-operative history was uneventful.

The post-operative albumin history was as follows:—

Date.	Albumin. Per Mille.	Quantity. Ozs.
Sept. 3 . . .	.25	26
" 4 . . .	.25	24
" 5 . . .	a trace	22
" 6 . . .	a trace	44
" 7 . . .	0	40
" 8 . . .	0	51
" 9 . . .	0	44
" 10 . . .	0	35
" 11 . . .	0	28
" 12 . . .	0	25
" 13 . . .	0	30
" 14 . . .	0	35
" 15 . . .	0	32
" 16 . . .	0	30

CASE II. (Case III. of Dr Simpson's series).—E. R. (female), aged 8 years 9 months. Transferred to surgical ward from Dr Simpson. She was admitted on account of persistent albuminuria and hæmaturia of three months' duration. There was slight body œdema and occasional vomiting.

The amount of blood and albumin varied considerably from day to day.

16th January 1919.—The right kidney was exposed, and the capsule stripped. The kidney was enlarged, and the capsule stripped with the greatest ease.

11th February 1919.—The left kidney was exposed, and the capsule stripped. This kidney was very distinctly enlarged. The capsule stripped with great ease.

Post-operative History.—The response to the first operation was not encouraging. On successive days after the first operation the amount of urine remained small; it measured respectively 10, 15, 10, 11, 12 oz. On the sixth day after operation a freer diuresis began to appear, and the daily quantity averaged 20 oz. From the date of the first operation to the date of the second operation albumin and blood were persistent in the urine in considerable quantity.

After the second operation on 11th February a more distinct improvement appeared—the average daily amount of urine rose to 30 oz., and the albumin and blood sensibly diminished. All trace of body œdema disappeared.

Capsule-Stripping for Subacute Nephritis

CASE III.—P. H. (male), 5 years. The illness dated from seven months before admission. It began as a streptococcal infection of the throat, and this was followed by an acute nephritis. Under medical treatment there was an improvement, but symptoms reappeared, and the urine persistently showed the presence of albumin and casts.

When admitted for surgical treatment there was marked œdema of the face and lower limbs; the urine contained a large quantity of albumin (7 per mille); the average daily amount of urine was 6 oz.

Operation, 11th November 1919.—The right kidney was exposed and the capsule stripped. The kidney was distinctly enlarged. The capsule stripped readily.

The operation caused distinct and almost immediate benefit: the average amount of urine rose to 25 oz.; the amount of albumin diminished from 7 per mille to 2.5 per mille.

Operation, 5th December 1919.—The left kidney was exposed and stripped. Its appearances were very similar to those of the right, an enlarged kidney with a freely stripping capsule.

Subsequent to the second operation the improvement was very striking. The average daily quantity of urine increased to 35 oz., and remained in this neighbourhood. The most striking improvement, however, was in the amount of albumin. This, which previous to the second operation averaged 2.5 per mille, diminished steadily in amount until three weeks after the second operation only a trace was detectable in the urine.

CASE IV.—J. G. (female), aged $7\frac{1}{2}$ years. 12th March 1920. This case is of especial interest, as catheterisation of the ureters was employed after stripping of one kidney in order to establish whether the post-operation diminution of albumin had a special relationship to a stripped side.

History.—Surgical treatment had been suggested on account of persistent body œdema with albuminuria.

She was found to be a pale child with considerable œdema of the face and legs. The urine showed 4 gms. albumin per litre: it contained a trace of blood and many granular casts; the average daily quantity was 12 oz.

Operation, 15th March 1920.—The right kidney was exposed and the capsule stripped. The kidney was enlarged: the capsule stripped readily.

Subsequently the amount of albumin diminished, and ten days after the operation it averaged .75 gms. per litre; the daily amount of urine averaged 22 oz. On the fourteenth day after operation the child was cystoscoped, and the ureter catheterised. The urine

John Fraser

from each kidney was collected and quantitatively examined for albumin. The amount obtained by the ureteral catheter was necessarily small, but sufficient in amount was obtained to show that the urine obtained from the right ureter contained the faintest trace of albumin, while the sample obtained from the left ureter (the unstripped kidney) contained a much higher percentage.

It was clear that the improvement in the amount of albumin depended upon the kidney, the capsule of which had been stripped.

Operation, 2nd April 1920.—The left kidney was exposed and stripped. As before, the kidney was enlarged, but its capsule stripped readily. Subsequent to the second operation the improvement was decidedly greater than after the first. The daily urine averaged 35 oz. ; the amount of albumin diminished until on the fourteenth day after the second operation only a trace could be discovered in the urine.

REMARKS.—The benefit derived from the operation is so great as to justify decapsulation of the kidneys in cases of chronic nephritis which do not improve under medical treatment. The results of catheterisation of the ureters show that after operation the kidney which has been stripped functions better than the other. It is advisable in all cases to operate on both kindeys, because while stripping one kidney often relieves all the symptoms for the time, the albuminuria continues, whereas the double operation offers a prospect of a cure. There is no advantage, but rather the reverse, in decapsulating both kidneys at the same time. The second operation should be postponed until the first has been recovered from.

CRITICAL REVIEW

RECENT ADVANCES IN THE DIAGNOSIS AND TREATMENT OF HYDROCEPHALUS AND INTRACRANIAL TUMOURS.

By W. Q. WOOD, M.D., F.R.C.S.Ed.

THE exact nature of the pathological lesion in hydrocephalus is often obscure and the results of surgical treatment are therefore often far from satisfactory. A large proportion of intracranial tumours occur in such situations that their exact position cannot be localised with any degree of certainty by ordinary methods of examination, or not until they have reached a stage when the prospects of their extirpation are small. So-called unlocalisable tumours at present comprise over half of the total number. Dandy of the Johns Hopkins Hospital has done pioneer work in introducing a method affording every hope of making an exact diagnosis in cases of hydrocephalus and of early and correct diagnosis in intracranial tumours.

In his most recent paper he deals with the pathology, the accurate diagnosis, and the treatment of cases of hydrocephalus due to stricture of the aqueduct of Sylvius. In congenital hydrocephalus of the "obstructive" type he finds that in 66 per cent. of cases the obstruction is situated in the Sylvian aqueduct, and only in the remaining 34 per cent. in the roof of the fourth ventricle, which has hitherto been regarded as the most common site of the obstruction. He points out that the great length and relatively tiny calibre of the aqueduct render it a place of least resistance to trauma or to the action of bacterial or other toxins during intra-uterine life. In seven cases of stricture of the aqueduct he found the entire aqueduct occluded in four; in one the structure was a thin diaphragm; in one there were two obstructions, one at the aqueduct and one in the roof of the fourth ventricle; and in one case the obstruction was not quite complete. He believes that the condition is due in most cases to the destruction of the lining epithelium of the aqueduct by the action of organismal or non-organismal toxins during intra-uterine life, the surrounding neuroglia invading and obstructing the canal.

By his brilliant experimental work he has shown conclusively the route which is followed by the cerebro-spinal fluid from its source of secretion to the area of its absorption. It is secreted mainly by the choroid plexuses of the lateral ventricles, and to a lesser extent also by those in the third and fourth ventricles. It passes from the lateral ventricles by way of the foramen of Monro to the third ventricle, and by the aqueduct of Sylvius to the fourth. It escapes from the fourth

ventricle by way of the foramina of Magendie and Luschka in the roof into the subarachnoid space. It then circulates in the large cisternæ at the base of the brain and slowly permeates the subarachnoid space to its ultimate ramifications in the sulci on the surface of the cerebral hemispheres. It is mainly from these minute radicles of the subarachnoid system that the cerebro-spinal fluid is absorbed into the blood-stream. Only a small proportion—about a fifth, as Dandy has shown—is absorbed from the cisternæ, and practically none from the ventricles themselves.

Cases of hydrocephalus can be subdivided into “obstructive” and “communicating” varieties. In the obstructive form the cerebro-spinal fluid is prevented from escaping from the ventricular system by some definite organic occlusion. In the communicating type no such occlusion is present and the ventricular system communicates freely with the subarachnoid space. This latter type is the so-called “idiopathic” form. Dandy shows by his experimental work and the result of careful post-mortem examinations that this form is due in most cases to a basal meningitis which seals off the communications between the cisternæ and the smaller ramifications of the subarachnoid space. The cerebro-spinal fluid circulates as far as the cisternæ but fails to reach the main absorbing area, with the result that accumulation takes place in the cisternæ and in the ventricles. Another possibility which is conceivable is a compression of the vein of Galen by adhesions, with resulting venous congestion of the choroid plexuses and hypersecretion of cerebro-spinal fluid. Such a compression must be situated near the commencement of the vein to produce any effect, and seems to be exceedingly rare in actual practice.

The distinction between the obstructive and the communicating types of hydrocephalus is readily made. One cubic centimetre of indigo-carmin is injected into a lateral ventricle and a lumbar puncture performed thirty minutes later. If the ventricles communicate with the subarachnoid space, the colour will have appeared in quantity in the spinal fluid by this time or shortly afterwards. If the indigo-carmin does not appear in the spinal fluid in the specified period of time, it is certain that an obstruction exists at some part of the ventricular system. It may be (1) at the foramen of Monro—a rare possibility—or, more probably, either (2) at the aqueduct of Sylvius or (3) at the basal foramina of Magendie and Luschka. To localise exactly the site of the lesion, Dandy employs the procedure which he has termed “ventriculography.” This consists in the examination of the shadow of the ventricular system by means of the X-rays, the shadow being obtained by aspirating the cerebro-spinal fluid and replacing it by air. This method of investigation was suggested by the results of examination of the abdominal and thoracic cavities by

Hydrocephalus and Intracranial Tumours

the X-rays. In filling a ventricle with a substance which would render its outline visible, it was necessary to select one which would be quite free from irritating effects; chemical substances such as bismuth, barium, or silver were out of the question. Halsted, of whom Dandy is a colleague, noted the distinctness of the shadow frequently produced by intestinal gases, even when obscured by bone, and his remarks suggested the utilisation of air or other gas for the examination of the ventricular system. Air has proved quite satisfactory and no other gas has been tried. A 20 c.c. Record syringe and a cannula with a two-way stopcock are used to empty gradually one lateral ventricle of its cerebro-spinal fluid, each syringe-ful of fluid being replaced by a syringe-ful of air, so that there is no risk of disturbing the intra-ventricular pressure. After this ventricle has been examined, the air can be made to pass in turn into the opposite lateral ventricle and then into the third and the fourth by suitable manipulations of the head, the air always rising to the highest point. X-ray photographs, or even examination with the screen, will show with the greatest distinctness the outline of the whole of the ventricular system. In the case of an adult the procedure involves the making of a small trephine opening, but this can be readily carried out under local anæsthesia. In a child the needle is passed through the anterior fontanelle or through a patent suture. In a case of hydrocephalus the distension of the lateral ventricles is at once apparent. If the case has been shown by the indigo-carmin test to be of the obstructive type, the diagnosis of the site of the obstruction depends on the appearance of the fourth ventricle. If no air can be made to pass into the fourth ventricle, then the obstruction must be at the aqueduct of Sylvius; if air passes down, then the obstruction must be due to occlusion of the foramina in the roof of the fourth ventricle.

Dandy has found this method of examination of the greatest value also in the localisation of brain tumours. He finds that a tumour of any size situated in either cerebral hemisphere will modify the shape, size, and position of the corresponding lateral ventricle. By ventriculography it is possible to get a separate profile ventriculogram of the whole of each lateral ventricle which will show any alteration in position or shape. In the case of a cerebellar tumour, an internal hydrocephalus is almost always present, and is demonstrated by the appearance of the symmetrically enlarged lateral ventricles. The diagnosis between a cerebral and a cerebellar tumour is at once cleared up. Dandy describes in detail five cases of brain tumour in which the localisation depended entirely on ventriculography. The method appears to be practically free from danger. Dandy has used it in seventy-five cases in Halsted's clinique in the past six months. The air appears simply to replace the cerebro-spinal fluid, and is

absorbed after a varying interval, its place being taken again by cerebro-spinal fluid.

The injection of air into the spinal canal by lumbar puncture after withdrawal of the cerebro-spinal fluid has also proved of value. The air passes upwards in the subarachnoid space until it fills the cerebral sulci. The whole subarachnoid area can then be seen in a roentgenogram. The cisternæ appear as large collections of air at the base of the brain, and the cerebral sulci as a network of tortuous filaments of air. Sometimes an air shadow will completely surround the cerebellum, showing clearly its shape and size. If adhesions are present in the region of the pons or mid-brain, as in most cases of communicating hydrocephalus, the air is prevented from passing up to the cerebral sulci, so that the exact site of the lesion can be located in this form of the disease. The upper part of the spinal cord, outlined by a column of air, can be clearly seen, so that it will, perhaps, also be possible to localise tumours of the spinal cord by this method.

Treatment of Hydrocephalus.—As a result of his observations, Dandy has endeavoured to place the treatment of hydrocephalus on a rational basis. In communicating hydrocephalus, the lesion in the great majority of cases is the presence of adhesions which block the connections between the cisternæ and the smaller branches of the subarachnoid space. It is not possible to deal directly with these adhesions. Attempts to side-track the excess of fluid by establishing communications with the retro-peritoneal space, the peritoneal cavity, the scalp, the venous system, the subdural space, or other spaces are futile. When connections are established with body spaces, the tissues soon wall off the fluid and cease to absorb it. Vascular communications soon cease to functionate, since the fluid which is to pass through is comparatively small in amount. The cerebro-spinal fluid secreted in twenty-four hours could be passed in a few minutes. The channel is functionless most of the time, and soon closes. Connections with the subdural space are also valueless; absorption from the avascular dura mater is very slight, the fluid does not pass into the absorbing subarachnoid space, and it continues to accumulate. Instead of attempting to hasten the removal of the cerebro-spinal fluid, we may endeavour to diminish its production. Sir Harold Stiles has ligatured both common carotid arteries with this end in view. Dandy recommends excision of the choroid plexuses from both lateral ventricles, in this way cutting down the production of the fluid by four-fifths. The remaining fifth, secreted in the third and fourth ventricles, is absorbed from the cisternæ of the subarachnoid space. One patient on whom he performed this operation is alive and well ten months afterwards.

Hydrocephalus and Intracranial Tumours

In hydrocephalus of the obstructive type the obstruction is situated, with few exceptions, either in the roof of the fourth ventricle, or in the aqueduct of Sylvius. In the former case a fresh communication is established in the roof of the fourth ventricle on the familiar lines. For cases of the latter variety, Dandy has devised an operation by which he re-forms the aqueduct. The cerebellum is freely exposed, the lower half of the vermis divided in the middle line, and the fourth ventricle widely opened. A small metal catheter is gently forced from below through the obstruction into the third ventricle. To maintain the newly formed channel, a small rubber catheter is introduced and left in position for two or three weeks after operation. This procedure has been carried out on two patients, both of whom recovered from the operation. One died of pneumonia several weeks afterwards, but the other is alive and well one year after operation. He walks freely without staggering, and talks both English and Norwegian readily.

It is as yet too early to speak of the value of these operative measures, but they have the merit of being founded on a sound physiological basis. By his method of ventriculography Dandy appears to have opened a new and most hopeful epoch in intracranial surgery. With the collaboration of a skilled radiologist there appears to be no reason why a surgeon should not obtain as lucid a picture of conditions inside the cranial cavity as is now obtainable of those in the abdomen or thorax.

REFERENCES.—¹ *Annals of Surgery*, 1918 and 1919. ² *Bulletin of the Johns Hopkins Hospital*, 1919. ³ *Surgery, Gynecology, and Obstetrics*, April and October, 1920. ⁴ Dandy and Blackfan, *American Journal of Diseases of Children*, 1917.

REPORTS OF SOCIETIES

FORFARSHIRE MEDICAL ASSOCIATION.

A MEETING of the Association was held in the conjoint School of Medicine, Dundee, on 25th November 1920. The President, Dr J. Mackie Whyte, in the Chair.

Patients shown were:—(1) Case of Jacksonian epilepsy of syphilitic origin, by the Chairman; (2) A mentally defective child with a penny in the œsophagus, by Dr J. A. Y. Rogers; (3) Case of aortic aneurism, by Dr Charles Kerr; (4) Three cases of ringworm undergoing treatment, by Dr G. Pirie, who later read a brief paper on its treatment by X-rays, with a resumé of 737 cases treated at the Dundee School Board Clinic; (5) Case of ununited fracture of humerus with shortening, by Mr W. L. Robertson.

The following *specimens* were exhibited:—(1) Uterus with carcinoma of cervix with inflammatory lesions in the left tube, by Dr Buist; (2) Rupture of ovarian tumour, rupture being discovered at operation, by Professor Kynoch; (3) Radiograms of two cases of perforating gastric ulcer in which the pancreas was involved, by Professor Price; (4) Dental radiograms, by Dr H. Gordon Campbell.

Dr W. G. Foggie read a paper on a case of acute lymphatic leucæmia in a married woman of 41 years. The course was a moderately rapid one. There was gangrene of the mouth beneath the tongue. The blood-count was rather unusual in that it showed about 9000 nucleated red cells per c.mm. Hæmorrhages into the organs were numerous. Post-mortem specimens and blood-films were shown.

NEW BOOKS

Warfare in the Human Body. By MORLEY ROBERTS. Pp. xii + 286. London: Eveleigh Nash Company, Ltd. 1920. Price 18s. net.

It is a far cry to Loch Awe, but it seems a further cry from the freshness of sea-breezes and from the chatter on deck or in the fo'c's'le of Morley Roberts' well-known sea-novels, to the erudition displayed in the volume under review. Readers will conclude that in biochemistry, in the elucidation of physiological and pathological problems Morley Roberts has found his work; while in novel-writing he has found his relaxation. It is an unusual sequence that an author publishes his lighter work before his deeper studies, but this is what Morley Roberts has done, and we have no fault to find with his performance. There may be few equally appreciative of

New Books

Morley Roberts in his two varieties of literary scintillation. For example, novel-readers will be puzzled to learn that a ship with its male and female passengers and its contained potentialities is like "an extruded zygote," but students of Mendelian principles will approve the aptness of the simile. Without doubt Morley Roberts has widened the circle of his readers and admirers.

Yet to the medical profession, to those of us who remember *Time and Thomas Waring*, the antithesis in style and matter is not so wonderful, and one recalls with professional pleasure the detail of operation theatre, symptoms, sensations, the operation, the anæsthetist, the surgeon: and one recognises that he who could so describe a carcinoma of the transverse colon (for that is what *Waring* must have suffered from) is no tyro in medicine or its allied sciences.

Warfare in the Human Body is divided into eleven chapters, each chapter an essay, each essay the groundwork of what might be a volume. "Method in Science" is followed by thirty-two pages on "Malignancy," which the author concludes with the suggestion that the cause need not be sought for in transplantation nor infection, but in the altered inter-relation of connective and epithelial tissue, and is linked to the balance maintained by endocrine activity.

"Repair in Evolution," "Inhibition and the Cardiac Vagus," and "The Theory of Immunity" are subsequent chapters, and indicate the wide horizon viewed in the book. The warning to bacteriologists against the coining of new terms which closes the chapter on Immunity is not unmerited, and might well have been associated with a plea for the consideration of existing terms and their reconstruction to indicate their inclusion.

Evolution, heredity, and the physiology of consciousness are dealt with in a manner which is at once enlightening and attractive, and the book closes with three appendices on the infective theory of cancer, the peroneus tertius, and Marcus Terentius Varro.

Warfare in the Human Body is a clever book well worth respectful study, and we give it our hearty recommendation.

It is preceded by a "Foreword" which is altogether admirable.

Five Years Old or Thereabouts. By MARGARET DRUMMOND, M.A.
Pp. xii + 180. London: Edward Arnold. 1920. Price
5s. net

This is a detailed and most sympathetic study of the mental development of a little girl of "five or thereabouts." Unlike so much that has been written about child psychology, it scarcely contains a dull page. Margaret is allowed to speak for herself, as befits her *title rôle*, and her communings rival *The Young Visitors* in human interest. Any summary of such a study would be inadequate. It has obviously

New Books

been a labour of love, and Miss Drummond has been most fortunate in having so charming a little girl to educate and "psychologise" on: the niece, if it be allowed to say so, is equally lucky in having so sympathetic and understanding an aunt.

The chief lesson to be learned from the book is one the importance of which is too little understood, though it is summed up in that most hackneyed phrase, "the child is father to the man." Nowadays, we must believe that from the point of view of character it is the earliest years that *really* count, and that the thing is done, and almost finished, in the nursery, before school age is reached. The nursery school or its equivalent is a logical consequence of studies like Miss Drummond's—indeed, of all modern psychology. There, not in any continuation classes, can higher education be given.

A medical reviewer must needs refer to the chapter on the sick child. Miss Drummond deals with some common maladies of the child-mind, and all that she says every doctor who understands children will endorse. This is a book which every parent will read with interest and from which he should learn something, if only a sense of his own responsibilities.

Pasteur: the History of a Mind. By EMILE DUCLAUX. Translated by Erwin F. Smith and Florence Hedges. Pp. xxxii + 352, with 37 illustrations. Philadelphia and London: W. B. Saunders Company. Price 21s. net.

This book may be commended to three kinds of readers. The man interested in and not altogether ignorant of scientific progress will find in it an epitome of Pasteur's work ranging from crystallography to immunity. The average practitioner of medicine, content to take on authority the doctrines of his teachers, may learn here with what patience experiment has been systematised to hypothesis and theory. And the born fool who should never see half done work may here be told what he will never learn, that Pallas no longer springs full armed from the head of Zeus.

Few readers will agree with the translators that Duclaux is like Boswell. Duclaux, indeed, does not profess to be in the ordinary sense a biographer. The style is heavy. The narrative is brightened with few personal sketches; in interest it is far below the biographies of Darwin, Huxley, and Lister. It falls short even of the aim of its title: it is less the history of a mind than a pretty heavy digest of important researches. There is, however, one graphic scene. Like Huxley, Pasteur shrank from the idea of vivisection. In a word-picture we see his delight when he finds a dog over whose comfort he had been worrying well and cheerful on the morning after it had been trepanned.

Foreign Books

The whole book is more of an Iliad than an Odyssey, a record of the battles of warriors on a friendly scientific field. There is no Polyphemus, no Circe, no Penelope, *nil humani*—none at least about Pasteur. On the other hand the biographical note of the translators on Duclaux is most graphic, touching, and pleasing.

The Assessment of Physical Fitness. By GEORGES DREYER, M.D., in collaboration with G. F. Hanson. Pp. xii + 116. London: Cassell & Company. 1920. Price 10s. net.

The method of estimating physical fitness advocated by the writers depends on correlating the weight, the length of the trunk, the circumference of the chest, and the vital capacity. Standard methods of obtaining these measurements are carefully described, and then from the tables given (which form the greater part of the book) it is a comparatively simple matter to calculate how far an individual deviates from the normal. For purposes of grading, individuals are classified on this basis as belonging to one of three groups. The whole method appears to be based on sound principles, and to be worthy of extended investigation here and in other countries.

FOREIGN BOOKS

Chirurgie Réparatrice et Orthopédique. Published under the direction of M. M. JEANBRAU, NOVÉ JOSSERAND, OMBRÉDANNE and DESFOSSES. 2 volumes. Pp. 1340, with 1040 illustrations. Paris, Masson et Cie., 1920. Price 80 frs.

These volumes have been written with the express object of furnishing the surgical world with an account of the lessons gained during the recent war, especially those lessons which are of value in civil practice. There are no less than forty-eight contributors, all of whom are recognised authorities in their respective subjects. Thus, Lemaître writes on "The Treatment of Wounds"; Sencert on "Injuries to Nerves and Vessels"; Policard on "Latent Infection"; Leriche on "Bone Regeneration," and "Flail Shoulder and Elbow Joints"; and Athanassio-Benisty on "Nerve Lesions of the Upper Extremity."

Four introductory chapters epitomise the new methods of treatment of wounds, compound fractures, wounds of joints, and the localisation and extraction of foreign bodies. The succeeding ten chapters deal with general topics, such as the sequelæ of injury to the integument, muscles, tendons, vessels, nerves, bones, and joints, and the principles of orthopædic and prosthetic appliances. The remaining chapters,

Foreign Books

which constitute the greater part of the work, treat the subject in a regional manner.

Though most of the teaching will be found to accord with the experience of surgeons in this country, there are some exceptions. For example, Sencert, in dealing with treatment of nerve gaps, states that free mobilisation of nerves is of little avail in approximating the ends, and that fixation of joints over which the nerves run in flexed position is not without danger. The use of a nerve graft is considered the method of choice, and the ideal graft is that recommended by Nagcotte, namely, the sciatic nerve of a calf, preserved in alcohol. Again, the very brief mention of transplantation of tendons for cases of irreparable injury to nerves, and the description of many mechanical devices to substitute the action of paralysed muscles, would lead the reader to assume the latter to be the preferable method of treatment.

This work, which must be regarded as truly representative of French opinion, will find an important place among treatises, war surgery, and in orthopædic literature, and will be welcomed by British surgeons.

Manuel d'Urethroskopie. By ROBERT HENRY and ANDRÉ DEMONCHY
Pp. 113, with 86 illustrations. Paris: Masson et Cie. 1920.

This manual offers to the surgeon desiring to improve his technique in the treatment of disease of the urethra an excellent opportunity of doing so. As the authors mention in their preface, the use of the urethroscope presents no particular difficulties. The technique is simple, and without danger in those cases where its use is indicated and justified, and the results of the examination are always fruitful in the information they convey. The various instruments employed for this purpose are illustrated, described, and the technique of their use detailed, and a chapter is given to a critical examination of the merits of the different varieties. Thereafter the appearances seen on examining the normal urethra are described and well illustrated with coloured plates.

The examination of the urethra, the site of disease, is similarly dealt with, and by verbal description and coloured illustrations the appearances seen are pointed out. There follows a description of certain methods of treating these lesions, and as this necessitates in most cases the use of special instruments for cauterisation, electrolysis, or catheterisation of such channels as the ejaculatory ducts, these are not only described, but illustrated by drawings and diagrams.

This manual forms an excellent book for reference in a branch of surgery that has made much progress in recent years.

The second part of Dr Birk's *Leitfaden der Kinderheilkunde* (A. Marcus & E. Weber, Bonn, 1920, price 25 m.) follows quickly

New Editions

on the first. It deals with disease of older children in the same clear and concise way that the first volume treated of the diseases of infancy. In many minor points the British reader will not be in full agreement with Dr Birk, but it is a good, practical guide to the subject for all that, and can be confidently recommended.

From the same publishing house comes Dr Erich Hofmann's *Behandlung der Haut und Geschlechtskrankheiten* (Third Edition, price 14 m.). In this little brochure the different skin and venereal diseases are arranged alphabetically, and under each is a brief description and note as to treatment. It is doubtful whether a book of this character will appeal to British readers; it is on the lines of an elementary students' manual, and the alphabetical arrangement presents certain drawbacks to a foreigner.

We have received the eighteenth and nineteenth volumes of the *Ergebnisse der innere Medizin und Kinderheilkunde* from Messrs Julius Springer, Berlin. This valuable series of critical reviews was well known in this country before the war, and the essays in the volumes for 1920 show no falling off either in interest or quality.

NEW EDITIONS

The Newer Methods of Blood and Urine Chemistry. By R. B. H. GRADWOHL, M.D., and A. J. BLAIVAS. Second Edition, illustrated. London: Henry Kimpton. 1920. Price 30s. net.

In present-day conditions laboratory examination of blood and urine has become an absolute necessity. No longer does chemical analysis of blood belong solely to the realm of experimental, physiological chemistry. The first edition of "Blood and Urine Chemistry" was good. The second has been brought up to date, and a number of new facts in technique and interpretation have been introduced. The book will be found exceedingly useful as a practical guide. The illustrations and plates are very well executed. To the student the value of the book is enhanced by the inclusion of an excellent bibliography.

Selected Lectures and Essays. By Sir JOHN BLAND SUTTON. Fourth Edition. Pp. xii + 320. London: Wm. Heinemann. 1920. Price 15s. net.

The sub-title of the book—*Ligaments, their Nature and Morphology*—though it describes the major thesis correctly enough, gives a prospective reader no hint of the variety of topics handled by the author's facile pen. Illuminating and original as are his lectures on

New Editions

comparative morphology and vestigial structures (one is tempted to ask whether any mammal has escaped his scalpel), it is probable that the general reader will turn with greater interest to Sir John's excursions along the bypaths of medicine, to his chapters on Old Testament usages in war and in disease, on natural history, on the anatomical principles underlying bull-fighting, and the like. In these general essays Sir John shows himself as learned a student and as skilled an adept in the comparative method, as in the earlier anatomical studies. The essays, one and all, are well worth possessing in this collected form.

Diagnosis of Disease. By HOBART AMORY HARE, M.D., B.Sc.
Eighth Edition. Pp. xii + 562, illustrated. London: Henry Kimpton. 1920. Price 36s. net.

The handling of general diagnosis of disease in this volume is very commendable. The emphasis which is laid on the symptoms and signs is all the more striking by the omission of laboratory methods. The various pathological phenomena of disease are taken up rather from the standpoint of locality than in divisions which come under various methods of examination. It gives the student of medicine, whether undergraduate or graduate, a good description of the signs and symptoms as they occur. There has been little attempt to explain the phenomena whereby the various signs and symptoms have been produced. If this had been done it would have made it much more interesting and profitable for the student.

Clinical Lectures on Enlargement of the Prostate. By Sir PETER J. FREYER, K.C.B. Fifth Edition. Pp. viii + 174, with 56 plates. London: Baillière, Tindall & Cox. 1920. Price 10s. 6d. net.

This book is written from the single standpoint of its author, and deals with his personal experience of cases of enlargement of the prostate. In the light of his contribution to the successful treatment of these cases, it remains of great historical interest. Freyer still holds the opinion that when his operation is performed a total enucleation of the entire organ in its true capsule is carried out. All the most recent work that has been done in this subject establishes a contrary view. This difference is not merely one of academic interest, but of important practical bearing from the operative standpoint.

Every surgeon who has to treat cases of prostatic enlargement and elects to do so by the performance of a suprapubic prostatectomy will naturally turn to the published works of Freyer on this subject as the originator of an operation that has revolutionised the treatment of these

New Editions

cases. The problem of the care of patients suffering from enlargement of the prostate has progressed very much beyond the scope of this book, and the solution of this the younger surgeon will find in other publications.

The Extra Pharmacopœia Vol. I. Seventeenth Edition. W. H. MARTINDALE, PH.D., PH.CH., F.C.S., and W. W. WESTCOTT, M.B., D.P.H. Pp. 1115. Price 27s. net.

This book will be found useful by every medical man. The articles on organotherapy, colloidal metals, nutrimenta, and vaccines give epitomes of standard and recent work on these subjects, and are indexes of monographs in books or current literature. One may find here rational formulæ for many drugs in common use, whose constitution practitioners are apt to forget. In the preface the authors make a strong claim for the rights of science in the commercial legislation of the country, ending by adapting the lines of Rupert Brooke to such men as Harrison, whose life was shortened by his work on poison gases, work none the less patriotic because it was professional.

ANALYTICAL NOTE

THE ROCHE TUBUNIC AMPOULE SYRINGE.

(THE HOFFMANN LA ROCHE CHEMICAL WORKS, LTD.)

It is a matter of great convenience and comfort to the practitioner to have ready a reliable means of immediately administering a drug hypodermically in cases of emergency. The vagaries of the hypodermic syringe are proverbial, and the time and trouble necessary to ensure perfect asepsis and accurate dosage is in many circumstances considerable.

To overcome these difficulties the Hoffmann-La Roche Company have devised an ingenious equipment which combines the required dose of the drug contained in a collapsible ampoule of pure tin, which acts as a syringe and is fitted with a hypodermic needle. The whole instrument is aseptic and hermetically sealed, and the mechanism is so simple and reliable that the administration of the drug can be accomplished in less than a minute. A wide range of sedative, stimulant, anæsthetic, antispasmodic, emetic and other drugs in different doses is included among the "Tubunic" solutions. These may be obtained separately or a selection fitted into a compact emergency case can be supplied.

The administration is so safe and simple that it may, if necessary, be entrusted to any intelligent attendant acting under medical instructions. We have had practical experience in the use of various drugs by this method, and can confidently recommend it. The price is reasonable.

NOTES

Honour—

The King has been pleased to confer the honour of Knighthood on Mr James Walker, Professor of Chemistry in the University of Edinburgh.

Royal College of Physicians—

At the Annual Meeting of the Royal College of Physicians of Edinburgh held on 2nd December 1920, Sir Robert W. Philip was re-elected President for the ensuing year. The other office-bearers for the year were appointed as follows:—Vice-President, Dr Harry Rainy; Councillors, Drs John W. Ballantyne, Francis D. Boyd, George M. Robertson, Robert Thin, and James Lamond Lackie; Treasurer, Dr Norman Walker; Secretary, Dr J. S. Fowler; Hon. Librarian, John William Ballantyne; Curator of the Research Laboratory, Dr J. J. Graham Brown.

George Sandison Brock, M.B.E., M.D., was elected a Fellow of the College.

At an Extraordinary Meeting held on 14th December 1920, Sir Robert Philip, President, in the Chair; Drs F. W. N. Haultain and John Macpherson, C.B., were elected as Representatives of the College on the Board of Management of the Royal Infirmary.

Royal College of Surgeons—

Mr David M. Greig, M.D., F.R.C.S., has been appointed Conservator of the Museum of the College.

At a meeting of the College held on 15th December, the following candidates having passed the requisite examinations were admitted Fellows:—William Barclay, William G. Borrie, Isidore M'W. Bourke, Ernest E. Bronstorff, Francis R. Brown, John Chisholm, John L. A. Grout, Gertrude M. A. Herzfeld, William R. C. Heslop, Robert L. Impey, Savariroyan Jesudason, Frank H. Kennedy, George E. Kidd, John T. M'Cullagh, Eric L. Mackenzie, Jack Morlet, Susil K. Mukhopadhyaya, Henry C. W. Nuttall, William T. Patterson, James W. G. H. Riddel, Harry D. Rollinson, Zachary M. H. Ross, William H. Simpson, Arthur C. Smith, John E. Stacey, William B. B. Taylor.

Higher Dental Diploma.—Mr Thomas Baxendale Patterson, L.D.S., R.C.S.Edin., having passed the requisite examinations received the Higher Dental Diploma.

University of Edinburgh—

At the Graduation Ceremonial held in the M'Ewan Hall on 17th December 1920, the following received the Degree of Doctor of Medicine:—John B. Alexander (*Commended for Thesis*), Stanley

Notes

Arnott, P. W. P. Bedford (*Highly Commended for Thesis*), Hugh P. Caithness, Frederick Dillon (*Thesis Gold Medal*), Jean D. Don, Frederick J. C. Johnstone, George J. I. Linklater (*Commended*), Isobel Mary MacLulich, Ada Johanna Macmillan, John M'C. A. Macmillan (*Commended*), James M. D. Scott, James M. Smellie, E. T. A. Stedeford, Roy M. Stewart (*Highly Commended*), Gladys Ward (*Commended*).

The following received the Degrees of Bachelor of Medicine and Bachelor of Surgery:—Edward H. Ablett, Isabella M. M. Aitken, Claude B. Brownlie, Evan M. Byres, Clarence A. Calder, Ernest H. Connell, Mary E. Cripps, Elizabeth E. Critchley, Cornelia J. J. Cross, Arthur W. G. Cumming, Andrew H. Cuthbert, William Eadie, Johannes W. Eijkelenboom, Dorothea M. Gall, Robert M. Galloway (*Second Class Honours*), Sydney G. H. Gasson, Isabella A. Gillespie, Israel Goldberg, Winsome D. Grantham, William L. Grassick, Henry A. C. Gregory, John D. Grierson, Errol F. Griffin, Thomas E. Hastings, Harold H. Holden, William L. Hunter, Elly Isserow, Robert Jackson, Maurice K. Jardine, Joseph P. Leckie, David R. Lewis, John K. C. Liddell, John S. Macbeth, Flora MacDonald, Isabella J. Macfie, Robert MacGarrol, Alexander L. M'Gregor (*First Class Honours*), Felix A. E. Meiné, Parakal S. Menon, James D. Mill, Rosemary O. Morris, Deborah F. Morrison, Harvey Nichol, Howel B. Pierce, Coenraad L. Pieters, Jacob W. Rabkin, Roberta T. Rankin, Marion E. Reid, Frederick H. Reynolds, Jossel Riesnik, David G. Robertson, Helena J. Robertson, John Robinson, George V. S. Rodriguez, Eileen S. P. Rowney, James G. R. Scarff, Jack Smith, Dorothy M. Somerville, Helen C. Spencer, Marguerite Stewart, Sydney S. Sumner, John B. Taylor, Leslie W. Thomas, John A. Thomson, Philippus C. du Toit, Oliver H. Wild, Anna M. Williams, David H. Williamson, Christine V. D. Willway.

The Diploma in Public Health was awarded to Robert M'M. Bowman, Gordon Lilico, Colin C. Philip.

Appointment.—Dr J. Crawford Dunlop has been appointed Registrar-General for Scotland.

BOOKS RECEIVED

- BACK, IVOR, and A. TUDOR EDWARDS. Surgery . (*J. & A. Churchill*) 15s.
- BOOTHBY, WALTER M., and IRENE SANDIFORD. Laboratory Manual of the Technic of Basal Metabolic Rate Determinations
(*W. B. Saunders Co., Ltd.*) 24s.
- BROWN, WILLIAM. Psychology and Psychotherapy . (*Edward Arnold*) 8s. 6d.
- BUCKLEY, ALBERT C. The Basis of Psychiatry.
(*J. B. Lippincott Company*) 30s.
- BURTON-OPITZ, RUSSELL. Advanced Lessons in Practical Physiology for Students of Medicine (*W. B. Saunders Co., Ltd.*) 18s.
- CROW, D. A. Pyorrhœa Alveolaris in its Clinical Aspect
(*Baillière, Tindall & Cox*) 6s.
- EMERSON, CHARLES PHILLIPS. Essentials of Medicine. 4th Edition.
(*J. B. Lippincott Company*) 12s. 6d.
- EWART, E. D. A Guide to Anatomy . (*H. K. Lewis & Co., Ltd.*) 16s.
- FACULTÉ DE MÉDECINE DE L'UNIVERSITÉ DE PARIS . (*Masson et Cie*) 1 fr.
- FOX, WILFRID S. Syphilis and its Treatment. (*H. K. Lewis & Co., Ltd.*) 36s.
- HESS, ALFRED F. Scurvy, Past and Present. (*J. B. Lippincott Company*) 18s.
- HOLLANDER, BERNARD. In Search of the Soul, and the Mechanism of Thought, Emotion and Conduct. In Two Volumes
(*Kegan Paul, Trench, Trubner & Co., Ltd.*) £2, 2s.
- INFANT WEIGHT CHART FOR DAILY RECORDS. (One Ounce Scale)
(*H. K. Lewis & Co., Ltd.*) 2s. 6d.
- JANSEN, MURK. On Bone Formation . (*Manchester University Press*) 20s.
- JOHNS HOPKINS HOSPITAL REPORTS. Investigation of the Central Nervous System (*The Johns Hopkins Press*) —
- KRAEPELIN, EMIL. Translated by R. MARY BARCLAY. Manic-Depressive Insanity and Paranoia (*E. & S. Livingstone*) 21s.
- LLEWELLYN, LL. JONES. Gout. (*Wm. Heinemann (Medical Books), Ltd.*) 30s.
- MACCALLUM, W. G. A Textbook of Pathology. Second Edition.
(*W. B. Saunders Co., Ltd.*) 45s.
- M'KENZIE, DAN. Diseases of the Ear, Nose and Throat.
(*Wm. Heinemann (Medical Books), Ltd.*) 42s.
- M'MECHAN, F. H., Edited by. Nitrous Oxide-Oxygen Analgesia and Anæsthesia in Normal Labor and Operative Obstetrics.
(*National Anæsthesia Research Society*) —
- MARSHALL, C. F., and E. G. FFRENCH. Syphilis and Venereal Diseases. 4th Edition (*Baillière, Tindall & Cox*) 25s.
- POWELL, R. DOUGLAS, and P. HORTON-SMITH HARTLEY. On Diseases of the Lungs and Pleuræ. Sixth Edition. (*H. K. Lewis & Co., Ltd.*) 42s.
- PRENTISS, CHARLES WILLIAM. Revised and Rewritten by LESLIE BRAINERD AREY. A Laboratory Manual and Textbook of Embryology. Third Edition (*W. B. Saunders Co., Ltd.*) 27s. 6d.
- VON REUSS, AUGUST RITTER. The Diseases of the New Born.
(*John Bale, Sons & Danielsson, Ltd.*) 52s. 6d.
- TRANSACTIONS OF THE AMERICAN OTOLOGICAL SOCIETY. Vol. XV. Part II. (*Mercury Publishing Co., New Bedford*) —

Edinburgh Medical Journal

March 1921

PRENATAL DEATH*

By ARTHUR ROBINSON

MR PRESIDENT, LADIES AND GENTLEMEN,—The Struthers lecture, which I have the honour to deliver to-day, was instituted by the will of the late Sir John Struthers. Its institution was an indication of the intense interest he took in the study of comparative anatomy, the knowledge of which he himself did so much to advance, at a period when the importance of the subject was less fully realised than it is to-day.

The terms of the will state that the lecturer appointed by the Council of the College may place before you either the results of his own work, or a review of the work which has been done by others, on any subject of anatomy or embryology, with the stipulation that pathology shall be excluded.

Two lectures have already been delivered, the first by Professor Arthur Keith, one of Professor Struthers' most distinguished pupils, the second by Professor Symington.

Professor Keith's lecture included a general survey and criticism of anatomists and their work, and Professor Symington discussed the relationship of the cerebral gyri to the inner surface of the cranial wall, in association with deductions which had previously been made with regard to the importance of those relationships and the conclusions that could be drawn from them in the case of prehistoric skulls.

The two first lectures, therefore, were concerned with the postnatal period of life. To-day I propose to enter on the prenatal field, to consider the occurrence of prenatal death and the sometimes consequent abortions, partly as subjects of scientific interest, and partly on account of their practical importance to breeders of animals, to those who are concerned

* The Sir John Struthers Lecture, delivered before the Royal College of Surgeons of Edinburgh, 17th December 1920.

Arthur Robinson

with the maintenance and possible increase of the human birth rate, and also to obstetricians in association with the advice which they give to some of their patients. It must be understood that by the term prenatal death is meant the death of ripe extruded ova, or of the zygotes formed by the union of such ova with spermatozoa before the termination of the normal period of gestation.

There appears to be a general belief amongst the laity, and also amongst those who concern themselves with the falling birth rate, in different countries, that sterility and prenatal death and the commonly following abortions, in human subjects, are very generally, if not entirely, due either to disease of the mother, or of the father, or of both, or to their abnormal environment, and, if one may judge from the statements made in standard text-books of obstetrics, the same view is, to some extent, shared and taught by obstetricians, in which case it must influence their advice and treatment. It is apparently believed that any ripe extruded ovum is capable of being fertilised by any spermatozoon in any given group of healthy animals, and that the zygote so formed will produce a new normal living individual, at the end of the usual period of gestation, except in those few cases in which the most superficial examination shows that the embryo formed by the zygote is abnormal. Further it appears to be assumed that if the embryo is obviously abnormal the abnormality is due to external detrimental conditions, similar to those which have been imposed on growing embryos by experimenters interested in estimating the effects of various artificial conditions upon the gametes and zygotes of various groups of animals.

In a text-book of Midwifery published in 1917 under the editorship of Dr Comyns Berkley, Dr A. Russel Andrews, and Dr J. S. Fairbairn, it is admitted that abortion may be due to conditions of the ovum and embryo, such as abnormalities incompatible with life,¹ but it is stated that the commonest causes are disease of the endometrium and uterine displacements in the earlier months, and syphilis and chronic metritis in the later months.

In his *Practice of Obstetrics* Dr J. C. Edgar, speaking of the causes of abortion, says "the causes in the ovum and embryo are many of them secondary to morbid conditions of the mother."⁸

Dr J. C. Williams²⁷ states that the foetal causes of abortion

Prenatal Death

are frequently due to abnormalities in the development of the embryo, but that abortion results more frequently from changes in the foetal appendages, which interfere with nutrition, such as excessive torsion of the cord, hydramnios, hydatiform mole, or syphilis.

All these statements may be more or less true, but the inference to be drawn from them is that the ovum and embryo have little or no direct influence in the production of abortion, and they do not explain why the embryo develops abnormally.

Drs Tweedy²⁵ and Wrench and other writers make no mention of the ovum or zygote as a causative agent of abortion.

In a recent number of the *British Medical Journal*² there was a leading article on "Nature's Teratological Experiments," inspired by Dr Browne's³ interesting work on Anencephalic Foetuses. The writer of the article suggests that the causes of abnormalities may be mechanical, toxæmic, microbic, or toxic, as recent workers have supposed, and he assumes that if that is the case, then, when our knowledge is sufficiently advanced we may hope to prevent their occurrence, but he also suggests that the causative agent may be something else. What the something else is he does not attempt to explain; possibly it is what Dr A. E. Giles, in his recently published and instructive book on Sterility in Women,⁹ classifies as "sexual incompatibility."

Speaking of sex incompatibility, Dr Giles says "we have no knowledge of its mode of action, nor of the means by which it might be overcome," but it is presumably to this named but unknown cause that he attributes part at least of the sterile marriages in this country, which he estimates as 15 per cent. of the total marriages. As will be seen later, it is this so-called sexual incompatibility with which we are primarily concerned to-day.

If prenatal death, and the abortion which necessarily follows it, in certain groups of animals, is so usually caused by disease, as the statements of obstetricians would suggest, the subject would scarcely be admissible for the purposes of a lecture delivered under the terms of Sir John Struthers' will, but I propose to place before you evidence which shows that prenatal death of extruded ova, and of some of the zygotes formed from them, is of frequent and regular occurrence in some groups of healthy mammals under ordinary conditions, and any occurrence which is usual in a group of animals, living under the ordinary conditions of life of the group, is normal. It is therefore under

that definition of the term normal that I shall speak of the average prenatal death rate of any group as the normal prenatal death rate.

If prenatal death under ordinary conditions is a very common and normal occurrence, it must be taken into account when any estimate is made of the possible birth rate of a given group of mammals, and when the cause of abortion in a given case is being considered. It is on these accounts that I venture to bring the subject before you now, and let me say at once that the evidence upon which I shall rely for the proof of my thesis that prenatal death and abortion are both, in many cases, normal occurrences, is derived partly from my own observations upon one group of mammals, partly from data very kindly given to me by Mr James Wood of the Scottish Board of Agriculture in the case of another group, and partly upon the published statements of several investigators who have dealt with the embryological history and productive capacity of various mammals from quite other points of view than that with which I am at present concerned.

I have already mentioned the widespread belief that prenatal death is very largely if not entirely due to disease. That belief received strong support from the late Professor Franklin P. Mall of Havard,¹³ who examined a large number of human specimens sent to him from various parts of America.

Mall's observations led him to the conclusion that the membranes of nearly all pathological ova are pathological, and it appeared to him that "were the difficulty germinal in origin the changes should be successive from the smallest to the largest pathological embryos, and should not arise from various stages of normal embryos."

It is somewhat difficult to determine exactly what Mall meant by the statement I have quoted. It appears to mean that an embryo which has reached a comparatively advanced stage of development before it shows any obvious signs of degeneration was originally normal. Such a position is untenable, for it assumes that a mechanism which shows no obvious signs of defect when it is first put into action is normal, although it may have an invisible structural defect which must result in its breakdown before the end of its normal period of working life is attained.

If, however, the statement means that if the defect is germinal breakdown should occur at all periods, both pre-

Prenatal Death

and post-natal, before the average life period is reached, then that is exactly what does occur.

The supposition that disease is most generally the cause of prenatal death has, however, not been without opponents who took the opposite view, and maintained that the embryo and not the mother was at fault; and there are others who have taken a neutral position, believing that the evidence, hitherto produced, was not sufficient to justify a definite decision.

Before a decision can be made two preliminary necessities must be satisfied :—

1. The ovum extrusion rate must be known.
2. The actual birth-rate must be ascertained.

When both sets of data, gathered from a satisfactory number of cases, are available, inquiry must be made as to the period at which prenatal death occurs, whether before or after fertilisation, and if after fertilisation whether before or after the attachment of the zygote to the uterine mucosa.

So far as I am aware the necessary data have not hitherto been furnished for any group of mammals. In 1914 Hammond inquired into some factors controlling fertility in domestic animals,¹⁰ and he published a number of data with regard to pigs and rabbits which are very helpful, and to which I shall have to refer later, but, as he himself admits, they are not sufficient to justify a definite conclusion.

The data which I have to place before you to-day are more satisfactory, but still not all that could be desired. They are data regarding two very different groups of mammals. Clydesdale and thoroughbred horses on the one hand, and ferrets on the other.

For the data regarding the horses I am indebted, as I have already said, to Mr James Wood of the Board of Agriculture for Scotland, who very kindly placed at my disposal the records of the matings of 390 Clydesdale stallions with 28,241 mares, and the records of the matings of 43 thoroughbred stallions with 3640 mares.

The numbers, therefore, in the case of the horses, may be considered sufficient, but, as none of the mothers died or were killed, the ovaries and genital canals were not examined, and in those respects the history is incomplete.

The number of the ferrets is by no means so satisfactory,

Arthur Robinson

only 165 being available for the purpose in hand ; fortunately they represent 1643 ova, the ovum production rate being 9.95 per animal at each breeding period, as calculated by the number of corpora lutea present in the ovaries.

Each group in itself is insufficient, but the evidence of both corresponds so well with regard to some points, and the gaps in the evidence of one group are so well filled by that given by the other, that the two together provide a not unsatisfactory basis on which conclusions can be established.

Further, as will be shown later, the conclusions, based on the data obtained from the two groups, are supported by notes made in association with observations and experiments carried out with quite other objects in view than that of demonstrating the amount and cause of prenatal death.

Taking first the records of the horses, it must be noted that all the stallions were certified as healthy by the officials of the Board of Agriculture.

There is no record of the health of the mares, but as no farmer would attempt to breed from an unhealthy mare it may fairly be assumed that the mares also were healthy.

The mare ovulates at every heat period, whether inseminated or not, and at least one ovum is then extruded from one or the other ovary. Occasionally twins are born ; sometimes, therefore, two ova are extruded, but how often that occurs is not certainly known, consequently, in order that the prenatal loss of extruded ova may not be overstated, I have assumed that not more than one ovum is extruded at each heat period.

If the mare is mated heat disappears, if the mating is successful, and remains absent until after parturition, but if the mating is unsuccessful heat appears again after a certain number of days.

There is no evidence, in the records, of remating, where the first mating was unsuccessful, but as the owners of the stallions were paid part of their fee after the mating, and the remaining part when a living foal was certified in the later months of gestation, and as each stallion served a certain limited district, there can be little doubt that some remating did occur, and that every opportunity was taken to secure fertilisation of the ova ; nevertheless the final result of the matings, in the case of the Clydesdales, was that only 52 per cent. of the mares were proved to be in foal, that is the prenatal death rate of the extruded ova was 48 per cent., or, in

Prenatal Death

other words, of the 28,241 extruded ova 13,560 disappeared entirely.

The loss of ova placed in favourable circumstances for fertilisation was undoubtedly great in the Clydesdales, but it was greater still in the thoroughbreds, for out of their 3640 shed ova 2136 disappeared, giving a proved foal rate of 42·32 per cent., and a prenatal death rate of 58·68 per cent.

The records of the Clydesdales extend over six years, 1913-1918 inclusive; those of the thoroughbreds over five years, 1913-1917 inclusive; and whilst the average prenatal mortality rate, for the whole period, was that already stated, there was, in both groups, a yearly variation which is shown in Table I.

TABLE I.

Year.	Clydesdales.			Thoroughbreds.		
	No. of Stallions.	No. of Mares.	P.N.M.R. per cent.	No. of Stallions.	No. of Mares.	P.N.M.R. per cent.
1913	57	1903	48·34	12	659	52·04
1914	86	3029	50·20	14	769	58·77
1915	155	6988	49·23	14	864	57·75
1916	153	5327	46·68	15	748	62·16
1917	144	5332	46·02	12	600	62·83
1918	130	5662	46·03	...	...	...

The yearly variation will have to be taken into account when the cause of the variations of the prenatal mortality rate is discussed; in the meantime it is important to note that, whilst the yearly variations in both groups are not great, the variations found in association with the matings of individual stallions and of one stallion as compared with another are very considerable.

As already stated, the average prenatal mortality rate of the Clydesdales, during a period of six years, was 48 per cent., but that actual percentage was met with only in the case of one stallion which was mated with 286 mares during a period of four years.

Four of the forty-four thoroughbreds were associated with a prenatal mortality rate of 58 per cent., which is practically the average rate of the whole group for a period of five years.

All the remaining stallions of both groups were associated with higher or lower rates varying from 0 to 100 per cent. in the case of the Clydesdales, and from 34·78 to 98·07 per cent. in the case of the thoroughbreds.

Arthur Robinson

The range of the variations is shown in Table II.

TABLE II.

A. Clydesdales.			
No. of Stallions.	No. of Mares.	P.N.M.R. per cent.	Average P.N.M.R. per cent.
9 12 26 61 81	33 264 1595 4831 7442	... 1 to 19.9 20 " 29.9 30 " 39.9 40 " 47.9	0.00 14.00 25.45 34.27 44.78
1	286	...	48.00
15 93 52 17 14 2 7	1977 7475 2877 850 446 134 31	48 to 49.9 50 " 59.9 69 " 69.9 70 " 79.9 80 " 89.9 90 " 99.9 ...	48.70 54.02 64.68 70.82 83.63 90.22 100.00
B. Thoroughbreds.			
1 7 11	46 769 1081	... 40 to 49.9 50 " 57.9	34.78 45.38 55.69
4	280	58 to 58.9	58.57
1 11 7 0 1	124 729 559 0 52	... 60 to 69.9 70 " 79.9 80 " 89.9 90 " 100	59.67 63.38 73.88 80.00 98.07

It is obvious, from the table, that in both groups more stallions are associated with a hypernormal than with a hypnormal prenatal death rate, and that the tendency to a hypernormal prenatal death rate is more marked in the case of the thoroughbreds than in that of the Clydesdales. The table also shows that there is a very marked prenatal loss of extruded ova in both groups, and that the variations of the loss are greater in the case of the Clydesdales than in the case of the thoroughbreds.

Discussion of the cause of the variations must for the moment be deferred, but it may be pointed out now that the smaller range of variation in the thoroughbreds is possibly due to the circumstance that no thoroughbred stallion was mated

Prenatal Death

with less than fourteen mares in any given year, whilst a considerable number of Clydesdale stallions were mated with fewer than ten mares in one year, and some with only one mare. Further discussion of this point at the present moment is not essential for the immediate purpose, which is to show that prenatal death of extruded ova placed in favourable conditions for development is common and is not limited to one group of animals.

The second series of animals available for the purpose in hand is the ferrets. Ferrets belong to a group of mammals far removed from the horses in zoological position, and they are specially useful for the present purpose not only on account of the comparatively small size of the ovaries, which, therefore, can readily be cut into serial sections for the microscopical examination of the corpora lutea, but also because the females belong to a relatively small group of female mammals which ovulate only after insemination, and in the case of the ferrets themselves, as I have shown in a previous communication,²⁰ only after spermatozoa have entered the caudal third of the oviduct. On account of this peculiarity it is quite certain that when corpora lutea are present in the ovaries the animals have been successfully inseminated, and that the ova shed, if they passed into the oviducts, had the opportunity of meeting spermatozoa. Moreover each ovary, in the case of the ferret, is enclosed in a peritoneal capsule which communicates with the general cavity of the peritoneum only through a very small orifice, which is guarded by one of the fimbriae of the ovarian end of the oviduct; therefore the chance of the escape of ova into the peritoneal cavity are small—nevertheless such escapes occur.

The uterus of the ferret consists of a very short body, which corresponds, practically, with the cervix of the human uterus, for gestation never takes place in it; the gestation areas being situated in the cornua and always in both cornua.

All my 165 ferrets were healthy. Some of them I received from breeders by whom they were dispatched to me either directly after insemination or at some later period. In the latter case they were kept separate from the male after the insemination had taken place until they were sent to me, and thereafter until they were killed. Others were sent to me in the early part of the year; they came on heat, and were inseminated in my laboratory under my own supervision.

I do not know the details of the feeding of the animals

Arthur Robinson

before they were sent to me, but they were all quite healthy when they arrived. In the laboratory they were fed with bread and milk, with occasional scraps of meat, and they remained healthy till they were killed, which in some cases was not until they had been in the laboratory for several months.

The environment in the laboratory was, to a certain extent, different from that of the breeding places, but it did not affect the health of the animals, and as the results obtained from the two groups, that is from those inseminated under the breeders' observation and killed immediately or some time after their arrival at the laboratory, and those inseminated in the laboratory were practically the same, environment had, apparently, no effect on the prenatal death rate.

The ripe ovarian follicles of the ferret rupture from eighteen hours to three or four days after insemination. The reasons for the variation in the time which elapses between insemination and ovulation do not concern the present purpose and they have been dealt with in the communication already referred to.²⁰

The number of ova shed by the 165 animals, as calculated by the number of corpora lutea in their ovaries, was 1643, that is about 9.95 per animal; therefore, although the number of animals is small the number of ova is more satisfactory.

The period of gestation in the ferret is usually forty-two days, and the animals were killed at intervals after insemination varying from eighteen hours to forty-two days.

The ovaries were cut into serial sections and the number of corpora lutea in each ovary was counted. The oviducts which run in the wall of the peri-ovarial peritoneal sac were cut with the ovaries.

Sometimes in the latter part of the fifth day, but more commonly on the sixth day, after extrusion from the ovaries, the ova or the zygotes formed from them enter the uterine cornua, and uterine cornua of the fifth, sixth, and seventh days were also cut into serial sections.

Some ova from ten to twelve days after extrusion from the ovary were washed out of the uterine cornua and were examined in the fresh state before fixation and hardening; others were cut, in situ, into serial sections.

From the tenth to the twelfth day the gestation chambers become visible, as slightly swollen areas of the uterine cornua, and after the twelfth day it is possible to distinguish normal from abnormal zygotes by the size of the gestation chambers

Prenatal Death

which they occupy, the zygote in the obviously small chambers being invariably in some stage of degeneration (Figs. 1-7, Plate I.).

From the thirteenth to the fourteenth day the placental part of the chorion of the zygote begins to fuse with the uterine decidua.

In ferrets, by microscopical examination of the ovaries in all stages of gestation it is possible to tell how many ova have been extruded in each animal after insemination has occurred; and by microscopical examination of the oviducts and uterine cornua in the early stages and by macroscopical and microscopical examination of the uterine cornua, in later stages the number of zygotes which resulted and their normal or abnormal condition can be ascertained. The results revealed by the methods mentioned are shown in Table III.

TABLE III.—*Ferrets.*

No. of days after Insemination.	No. of Animals.	No. of Corpora Lutea.	No. of Ova or Zygotes.	P.N.M.R. per cent.	Average P.N.M.R. per cent.
1-2	10	84	83	1.19	16.03
2-3	15	127	123	3.14	
3-4	8	78	70	10.25	
4-5	7	66	61	7.55	
5-6	11	107	60	43.29	
6	6	68	48	29.41	
7	3	30	22	26.66	23.64
8	7	68	56	17.64	
9	7	68	49	27.94	
10	3	28	24	14.28	
11	11	117	88	24.78	
12	7	71	53	25.35	
13	13	117	89	23.93	
14	7	76	59	22.36	22.18
15	10	102	75	26.49	
16	1	9	8	11.11	
17	1	9	8	11.11	
18	5	46	41	10.89	
19	3	26	19	26.92	
20	2	25	18	28.00	
21	2	23	17	26.08	18.60
22	2	20	18	10.00	
23	1	11	7	36.36	37.81
29	4	43	23	46.51	
30	4	38	33	13.15	
31	2	27	11	59.25	
35	2	8	0	100.00	47.79
36	2	29	18	37.93	
37	2	122	65	46.72	
42	10	122	65	46.72	
	165	1643	1246	...	24.16

Arthur Robinson

The percentage prenatal death rate of the extruded ova of ferrets, as shown by the examination of the 165 specimens killed at various periods of gestation, is 24.16 per cent. That rate, however, is not the true prenatal death rate, comparable with the rate of the Clydesdale and thoroughbred horses; it is merely the rate revealed by the killing of animals, not at the end of the gestation period, but at the end of various periods of gestation.

The figures in Table III. reveal an increase of 20.47 per cent. between the prenatal death rate of the first two weeks of gestation and that of the last three weeks, whilst if the animals of the last four weeks are compared with those of the first two weeks, an increase of 11.8 per cent. in the prenatal death rate is found in the last four weeks as compared with the prenatal death rate of the first two weeks.

In spite, therefore, of the small numbers available in the later period, as compared with the larger numbers in the earlier period, there can be little doubt that some of the ova and zygotes, which appeared to be normal in the first two weeks of gestation, would have shown signs of degeneration if the mothers had been killed in the later weeks.

Ferret breeders give the average birth rate of ferrets as 6 per animal at each breeding period, that is 600 per cent.

The ovum production rate, as estimated on my 165 animals, is 995 per cent.; therefore, comparing the birth rate as stated by the breeders with the ovum production rate of my specimens the prenatal death rate would be 39.23 per cent.

It is possible that the rate so calculated is too high, for the breeders are careful not to interfere with the mother or the young for several days after the birth period, under the impression that any interference is liable to cause the mother to eat the young.

My own observations lead me to believe that if the number of the young was counted directly after parturition was completed it would be found that the average birth rate was more than six per animal, for I have notes of several cases of seven and nine young. It is rare, however, for all the young of one brood to be of the same size and robustness, and I have noted, quite frequently, that some of the weaker animals died during the first five days after birth.

It must be admitted, however, that, with the material at present available, it is not possible to fix exactly the normal prenatal death rate of ferrets, but it may be said that it is

Prenatal Death

certainly not more than 39.23 per cent., and possibly it may not be more than 35 per cent.

Fortunately for the purpose in hand the exact percentage is not of great importance; the main point is that the records show that in ferrets, as in Clydesdale and thoroughbred horses, the prenatal death rate is high, that it occurs in association with healthy animals placed in a normal environment, and that it is very variable, the variations in the ferret ranging between 1.19 per cent. and 100 per cent.

Prenatal death, however, is not limited to horses and ferrets, but the references to it are, in many cases, merely incidental notes in communications dealing with entirely different subjects, and the data given are too few to justify any conclusion as to its exact amount; they are sufficient, however, to show that it is both common and considerable in amount, and variable in its incidence in different animals of the same group.

In *Dasyurus*, amongst the marsupials, prenatal death seems to be of large amount, for Hill¹¹ states that whilst six is the number of nipples of the adult female, and six, therefore, the maximum number of the young she can rear, he has several records of from 20 to 25 extruded ova, one of 30, and one of 35, of which 23 were normal and 12 abnormal; he notes further that cleavage abnormalities were frequently met with.

Hill suggests that the occasional presence of eight teats instead of six, and the excessive ovum production, indicates that *Dasyurus* was originally more prolific. That may possibly be the case, but it also seems possible that the excessive ovum production and zygote formation is, in a sense, a precaution to assure that a number of strong zygotes, sufficient to carry on the species, shall be produced at each birth period.

In the case of swine, the sow ovulates independently of insemination, and Hammond found (1914), by the examination of the ovaries of 27 animals killed just after the heat period, that the average number of corpora lutea was 20 per animal, that is the average number of ova extruded at each heat period is 20 per animal, whilst the average litter of young pigs is 12, which indicates a death rate of 40 per cent. of the shed ova.

According to Rommel, quoted by Hammond²¹ and Surface²⁴ the average litter in American breeds of swine is less than 12, in Duroc-Jerseys 9, and in Poland-Chinas 7.5, but, unfortunately, there are no data to show the ovum production rate of those varieties.

Arthur Robinson

In a second series of 7 sows, killed in various stages of gestation, Hammond found 126 corpora lutea in the ovaries, and 92 normal zygotes in the uteri; the prenatal death rate of the extruded ova was therefore 26.98 per cent., which is much lower than the prenatal death rate estimated upon the ovum extrusion rate of his first series and the average birth rate. The difference between the two results emphasises the fact, already indicated by the ferrets, that prenatal death rate estimated upon the number of corpora lutea in the ovaries and the number of normal zygotes in the uteri of a series of animals killed in various stages of gestation does not give the true prenatal death rate, because it does not take into account the zygotes which were apparently normal in the earlier stages, but which would have undergone degeneration in the later periods.

Hammond's results, though they are based on small numbers, show that in swine, as in horses, ferrets, and marsupials, the prenatal death rate is large, and that, even in his small series, it varied from 0.00 per cent. to 47.61 per cent.

Hammond also examined a series of 38 rabbits which were killed from the ninth to the twenty-fifth day of gestation, and it appears from his table of results that the prenatal death rate of the series was 31.25 per cent., a figure which must be less than the total prenatal death rate, for the reasons given in association with the consideration of ferrets and swine, and it is certainly less than that shown by contrasting the ovum production rate with the average birth rate. In Hammond's series of rabbits the ovum production rate as shown by the number of corpora lutea was 9.6 per animal, that is 960 per cent. The average litter is stated by breeders as 5 per animal, or 500 per cent., from which it follows that the total average prenatal death rate is 37.50 per cent.

Hammond's tables show that the prenatal death rate varies in rabbits as it does in other mammals, but the figures given do not permit a definite estimate of the amount of variation to be made.

In guinea-pigs it appears from the tables given by Stockard and Papanicolaou, in the record of their experiments on the modification of the germ cells in mammals,²² that the prenatal death rate of normal non-inbred lines is 13.30 per cent. and in partially inbred lines 19.51 per cent., the estimate being based upon 238 animals of the former group and 45 of the latter; but the figures given in Stockard's tables are not

Prenatal Death

supposed to represent the total prenatal death rate for they do not include the ova which escaped fertilisation, except in those cases in which no ova were fertilised, nor do they include zygotes which died during the first eight days of gestation, for the number of zygotes formed was estimated by palpating the animals, the authors stating that the gestation chambers can be recognised in that way from the eighth to the tenth day onwards.

I have shown that in ferrets many deaths occur before the eighth day of gestation, and there can be little doubt that similar early deaths take place in most mammals, therefore as a large number of early deaths are not accounted for in Stockard's and Papanicolaou's tables it may fairly be assumed that the total prenatal death rate is considerably above the 13.30 per cent. for normal non-inbred animals.

Unfortunately the ovum production rate of guinea-pigs is not known for Stockard's and Papanicolaou's animals were not killed, consequently the number of corpora lutea in their ovaries is unknown ; therefore, even if the average birth rate was available, it would still be impossible to estimate the total prenatal mortality rate. It is clear, however, from the figures given that in guinea-pigs, as in other mammals, the prenatal mortality rate is very variable, being low in some and higher in other animals, and it is equally clear that it can be altered by modifications of the conditions of life.

(To be continued.)

EPIDIDYMITIS AND ORCHITIS FROM MUSCULAR STRAIN FOLLOWED BY TUBERCULOSIS OF THE EPIDIDYMIS.*

By CHARLES W. CATHCART, F.R.C.S.

A FEW years ago, in the Sheriff Court in Edinburgh, a workman's compensation case was tried, in which, as far as I could gather, the decision turned upon the answers to two important surgical questions. The first and crucial one was whether or not a severe muscular strain of the abdominal wall can within an hour or two set up acute orchitis and epididymitis apart from any direct injury to the parts and in the absence of any gonococcal infection of the urethra. The second was whether or not such an attack of acute inflammation could be the exciting cause of a subacute tuberculosis of the affected parts when the one attack passed insidiously into the other.

The workman in question was suffering from tuberculosis of the epididymis, and sued for compensation on the ground that the disease had arisen from the results of a severe strain incurred in the course of his work.

The following history of the case was narrated in Court by the claimant, and corroborated in its details by witnesses:—

Richard P., aged 21, was employed in a Rosewell coal pit as an "oncost clipper," *i.e.* a man who "clips," or fixes, hutches on to a haulage rope which draws them along a rough underground tramline. Should any of the hutches leave the rails, it is his duty to replace them.

On the evening of Sunday 26th April 1914, P. left his parents' house in his usual good health and began work underground at 8 P.M. About midnight five hutches, each carrying about 10 cwt. of coal, left the rails at a point in the roadway where an awkward turn made it more than usually difficult to replace them. By means of a lever he eased the hutches nearer to the rails, and then lifted them one by one into position. His manner of lifting should be noted. Placing his back against one end of the hutch, and with his arms behind him, he grasped a lifting ring with each hand, and with a great strain raised the hutch well off the ground and moved it into its place. (This would no doubt be done in stages, and chiefly by straightening his back and legs, thus involving powerful contraction of all the trunk muscles.) In this manner he replaced four of the five derailed hutches. When,

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Epididymitis, etc., followed by Tuberculosis

however, he had raised the fifth one about 18 inches from the ground he suddenly felt a sharp pain in the lower part of the abdomen on the left side, and shortly afterwards the pain "gripped" him in the left testicle. He succeeded in placing the hutch in position and was able to walk along with the hutches, although the pain increased as he went. Soon he felt sick and sat down for about ten minutes. On resuming the journey he continued slowly till he reached the pump-house, about half a mile away. Here he took supper. About half an hour after the strain he noticed that his scrotum was swollen, and on examination found that the skin of the scrotum was reddened. After his supper he took the hutches to the pit bottom, which he reached between 3 and 4 A.M., and lay down beside the engine-room fire till his shift should end at 4 A.M. He told the engineman that he had ruptured himself, and the engineman recognised the swelling of the scrotum through his clothes. On returning home, shortly after 4 A.M., he told his father that he had ruptured himself, and gave that as his reason for being unable to fulfil his promise, previously made, to work in the garden on the following forenoon. He undressed and went to bed, and his father observed the swelling of the scrotum and the "darkness" of its skin. His own medical attendant, Dr Young, was on holiday, but the *locum tenens* called about 2 P.M. on the Monday and prescribed "something to paint the part." Dr Young saw him on the Wednesday and found the left testicle swollen. The pain subsided after a few days, but returned with renewed severity about fourteen days after the strain. Warm fomentations were applied repeatedly, and in about four and a half weeks after the strain Dr Young incised a fluctuating swelling in the left side of the scrotum and evacuated watery pus. The incision remained open and became a typical tuberculous sinus, leading to a nodular epididymis. He was confined to bed in all about six weeks.

Previous Health.—Up to the time of the injury he had been in good health, and had had no occasion to consult his doctor. During the year preceding the injury he had worked on an average six shifts a week. On the evening of the 14th April his father and mother had seen him start for his work in his usual health. An uncle who had met him in the pit before the strain and had noticed that he seemed quite well, saw him again shortly after the strain and was struck by his looking "very bad."

P. denied having ever suffered from venereal disease, and Dr Young found no reason to disbelieve his word.

After the sinus had continued to discharge for several months, a medical man was able to express some fluid from the urethra which contained staphylococci but no gonococci. This might easily have reached the prostatic urethra through the vas deferens of the affected side.

On the basis of this clearly stated case, Dr John Spence and I supported P.'s claim. Other medical witnesses opposed it, and in the end the Sheriff ruled that the claimant had "not proved his case."

If there were any purely legal questions involved, they do not concern the medical profession. What concerns us is, do such forms of injury happen? If yes, can they, like other injuries, excite a local focus of tuberculosis into activity or give rise to the development of a new one? An interesting but subsidiary question is, what is the mechanism of such an injury if it occurs? It is necessary, however, to maintain that this latter question is only of subsidiary importance, for we are all familiar with unmistakable injuries from accident, such as fracture of the base of the skull, or the tearing of a semilunar cartilage, where the exact mechanism of the injury has long been and is still under dispute.

The answers to all the questions involved must be based on clinical experience. I have therefore culled from various sources the records of other cases which by their similarity confirm the chief features of the present one, and by their points of difference throw light on certain aspects of it.

My attention was first drawn to the subject by a short record of three cases of acute orchitis immediately following a strain referred to by the author of "Rest and Pain" in one of his published clinical lectures.¹ These cases were afterwards published in greater detail by Mr Birkett in Holmes' *System of Surgery*.² They are headed:—

"Rupture of the Vas Deferens.—Injuries of the excretory duct of the testis, or vas deferens, are not noticed by surgical authors. Mr Hilton has favoured me with the history of three cases, in which he believes this duct was torn completely across.

"CASE 1.—A gentleman, between 19 and 20 years old, was skating, and, in attempting to cut a particular figure, in which he swung himself round with great effort, he suddenly slipped, so that his right leg was violently abducted. At the same moment he felt something give way in his right groin, accompanied with great pain. The right testis had not been the seat of direct injury, yet it began to swell almost immediately, and in a few hours blood passed from the urethra. Perfectly clear urine flowed away through a catheter, introduced into the bladder, without any blood. This was an indication that the blood had entered the urethra, and that it did not come from the bladder or kidneys. The blood seemed to be arterial, but

Epididymitis, etc., followed by Tuberculosis

it was in small quantity. There was continued tenderness and pain near the right inguinal ring, and swelling of the right testis. Leeches were applied over the lower part of the abdomen, and he was confined to bed for two or three days, suffering much local pain resembling peritonitis, with considerable pyrexia. The bleeding from the urethra did not continue after the second day. The testis remained swollen for several weeks and then began to waste, until at last it was reduced to about one-third its normal size. At this time, now six years since the accident occurred, the patient reports that the testis is of the ordinary size of the organ in a boy of 12 years old. In its present condition it causes no inconvenience.

"CASE 2.—A man, about 28 years old, was quickly wheeling a barrow with two handles in the dark, when he was suddenly arrested in his course by the barrow meeting with an obstruction. The weight recoiled upon him, and shook him very much at the lower part of the abdomen. He stated that he felt something 'give way' in his right groin. Arterial blood flowed from the urethra almost immediately after, and when seen an hour after the injury he was then bleeding. Mr Hilton passed a catheter, and drew off perfectly clear and bloodless urine. This case was attended with nearly the same local symptoms as the last, although not quite so severe or so prolonged. It was treated in the same way, except that a few leeches were applied to the testis, and with advantage. A fortnight after the injury, the right testis was much enlarged, and slightly painful on pressure. The opportunity for further observation has not occurred.

"CASE 3.—A gentleman, about 60 years old, was running upstairs in pursuit of one of his children. Hoping more certainly to overtake the child, he made a violent effort to catch hold of her foot as she was turning the corner of the stairs. This he failed to do, and fell with his knees upon the step, but did not strike the groin. He felt a sudden pain and something 'give way' in the right groin, close to the internal abdominal ring, and presently blood trickled from the urethra. Mr Hilton saw the patient about two hours after the injury had been inflicted. He introduced a catheter into the bladder, and the urine passed through it perfectly clear and bloodless. The patient was confined to bed for nearly fourteen days, with swollen testis and pain deeply seated behind the internal abdominal ring. Leeches were applied to the lower part of the abdomen and testis. During four or five days a small and diminishing quantity of blood passed from the orifice of the urethra. The right testis subsequently diminished very considerably, and when an examination was made, several months after the injury, it was not more than half the size of the left.

"In the details of the above cases there seem to be very good reasons to concur in the opinion that the injury sustained by these

men was laceration of the vas deferens. Mr Hilton considers that this duct is divided within the abdomen, between the internal abdominal ring and the point where it crosses the ureter, and that the blood flows from the artery which accompanies it. The blood from this vessel traverses the tube, and so enters the prostatic portion of the urethra, anterior to the bladder, thus leaving the urine free from blood.

"He adduces, in corroboration of the views above expressed, the details of a case dissected by him, in which he accidentally found one testis excessively atrophied, and the vas deferens of the same gland ruptured and closed at both ends. The ends were at least two inches apart. The lowermost was lying near the crossing of its course with the ureter; the upper end was adherent to the surrounding connective tissue, near the internal ring. The vesicula seminalis on the same side was smaller than that on the opposite. These cases have many points in common with others that have been published but are peculiar in having such a clear history of blood passing from the urethra shortly after the injury. Possibly in some cases it may not have occurred, while in others it may not have been observed or thought worth recording."

I shall refer later on to the suggested explanation of the symptoms as due to rupture of the vas deferens, and pass on to the account of a case which was under my care in the Royal Infirmary with a somewhat similar history:—

James D., aged 44, admitted in December 1903 to Ward 18, Royal Infirmary, Edinburgh, on account of a swollen and painful condition of the left testicle which had lasted for about ten years and had been caused by a strain. The epididymis was swollen and somewhat hard and the cord thickened. I was uncertain of the diagnosis, but thought tuberculosis unlikely. The case interested me from its points of resemblance to those recorded by Hilton. It differed, however, in showing chronic inflammation of the testis instead of atrophy as an after result.

History.—The patient, James D., a "power turner" in a Tweed Mill, in the winter of 1892 was stooping down to receive on his shoulder a quantity of yarn rolled on a beam, weighing in all about 3 cwts. His fellow workman, who was to have placed it on his shoulder, let it slip and it came down heavily and unexpectedly on his shoulders. He made a great effort to prevent himself from being borne down by the weight, and although he gave way he did not fall. He was anxious to prevent the yarn from reaching the floor. At the moment when he made the great strain he felt as if something had torn in the groin, and there was great pain about the testicle and in the groin. He was able, however, to carry the weight the few feet

Epididymitis, etc., followed by Tuberculosis

required to put the beam in its place. This was about the end of the day's work and he continued to work for about half an hour.

His wife remembers of his coming home that day. He was feeling "that sick" that he could do nothing that evening and went to bed at once. He did not vomit. He said he had racked himself and felt very much swollen in the "bag." His wife put on fomentations that night and all the next day. She noticed the swelling about one and a half hours after the strain. About two or three days after the injury he passed a blood-stained fluid by the urethra. He complained of it and his wife saw it on his nightshirt.

Afterwards, he often had some greenish, thick discharge from the urethra. This went on for some years, the least exercise brought it on and it was only finally cured when the testicle was removed.

He was in bed for about a fortnight with the swelling and pain in the testicle gradually going down, and then he returned to work; but for eighteen months before admission to the Infirmary, the pain grew so much worse that he could scarcely walk.

At the time of the injury he had been married about eight years, and had three children. Two more were born after the injury.

He never had any venereal disease, nor discharge of any kind till after the injury. Dr M. who attended him after the injury knew him very well, and was quite satisfied with the explanation of the injury.

There had been no previous twists or pains in the left testicle.

The testicle was excised. The pathologist's report on it is as follows:—

"The main condition here is chronic epididymitis and chronic hydrocele. Even in the testis there is fibrous formation along the seminiferous tubules, which are dilated and whose epithelium is altered. Between the tubules the lymphatics contain numerous phagocytic endothelial cells containing pigment and occasionally red corpuscles."

The records of the following two similar cases are important because of the definite exclusion of gonococcal infection by direct inspection of the urethra with the urethroscope. They were published by Dr Arnold Edwards as cases of "Acute Epididymitis from Muscular Strain."³

"CASE 1.—A strong, muscular moulder, aged 27, seven years married and the father of four children, was on 17th February 1911 carrying, with the help of a labourer, a large shank of molten metal, when he accidentally stepped with his left foot on to a piece of scrap-iron. This false step nearly threw him to the ground, but he made a desperate effort to regain his balance by suddenly throwing his whole weight on to his right leg. A slight pain referred to the right groin and a sensation of faintness and nausea followed. He assured me no

direct blow was received on the groin or scrotum, nor were the scrotal contents nipped between the thighs or by the fork of the trousers. All his symptoms disappeared in a few minutes, and work was then resumed. About seven or eight days later, however, he noticed some swelling of the right testicle, which, increasing in size and becoming more and more painful, finally compelled him to discontinue.

"The man's employers became suspicious of the nature of his complaint, and sent him to me on 28th February for examination. There was then well-marked epididymitis on the right side, but the inflammation did not involve the secretory portion of the testicle. The swollen epididymis was about three times its normal size, and painful on pressure; the spermatic cord was uniformly enlarged and sensitive. The veins showed no varicosity. No discharge could be obtained from the meatus even after repeatedly stroking the canal with the finger from the bulb forwards, and a three hours' urine passed into two test-glasses showed neither cloudiness or urethral shreds in either portion. Both the vesiculæ seminales and prostate were healthy.

"When the man presented himself for further examination a week later, he had retained the urine for six hours in obedience to my instructions, and an examination of it revealed no abnormality. The swelling of the epididymis had now largely subsided, and after obtaining the man's consent I proceeded to urethroscopy him. The anterior urethra was found after the closest investigation with a Wyndham Powell urethroscope and my telescopic attachment to be entirely-free from disease, and in fact to harmonise with the man's statement that he had never suffered from any gonorrhœal affection. The posterior urethra was then examined by Wossidlo's instrument with negative results, the whole of the mucosa of this region, including the colliculus seminalis, the orifice of the prostatic utricle, and the mouths of the ejaculatory and prostatic ducts, being absolutely normal and presenting no appearance of having been diseased. There was no personal or family history of tuberculosis, rheumatism, or gout, and the lungs were found to be thoroughly sound. As he had resided in Manchester all his life and had never been abroad, the question of malaria, a reputed cause of primary epididymitis, was not considered. I consequently reported to the man's employers that the case was undoubtedly due to accident. Two weeks later, when I saw him again, every trace of epididymitis had disappeared, and he informed me that he had been back at work for the past three days.

"CASE 2.—The patient was a strongly-built gentleman, 41 years of age, who was inclined to corpulency, but had in earlier life been a well-known athlete. Although married ten years no children had resulted from the union. His previous health would have been excellent but for the fact that he had suffered for the last four or five years from

Epididymitis, etc., followed by Tuberculosis

piles. He had an exceptionally good family history, and he positively assured me that he had never contracted gonorrhœa.

"On 11th May 1911, he was, during a 'spring cleaning,' lifting unaided one end of a heavy upright grand piano while standing on his left foot and simultaneously using his right foot to push the carpet into its place under the piano. While doing this, he experienced a sensation as if—to use his own words—'something suddenly tore' on the left side of the scrotum. There was practically no real pain at the time, but he became thoroughly exhausted immediately afterwards and was compelled to lie down. About an hour later he noticed that his piles had bled rather freely.

"On 19th May, eight days after the accident, his left testicle began to ache considerably, and he discovered that it was reddened and nearly as large as his fist. He visited me the following day. There was then decided enlargement and tenderness of the left epididymis, and the inflammation was sharply confined to this part of the organ. The cord for some distance upwards was sensitive, and decidedly but uniformly thickened. A distinct recent ecchymotic discoloration could be seen on the left side of the scrotum. There was a double varicocele, but the varicosity was much more pronounced on the left side. The prostate was normal, and the vesiculæ seminales could not be felt. No discharge could be expressed from the urethra, and the urine on inspection was clear and free from filaments.

"On 31st May the swelling of the epididymis had entirely subsided without leaving the slightest thickening, the treatment employed being merely rest, applications of Caspar's ointment, and hot fomentations. The discoloration of the skin had also disappeared. The whole urethra was then minutely explored with the same instruments as were employed in the former case, and I was thoroughly satisfied that the urethroscopic appearances were perfectly normal, and that no sign of urethritis was present."

Later in the same year Dr J. W. Geary Grant published two very similar cases,⁴ and in the first of them the epididymitis was bilateral, although pain had been felt on one side only:—

"CASE 1.—A. B., aged 39, on Thursday, whilst standing on two joists of a flooring with the feet about 16 inches apart, swung round a plank from the scaffolding, and as he did so 'felt a slight sting in the right groin.' No squeeze or blow. Pain was felt in groin, not testis; it was so slight that it did not cause him to stop his work, even momentarily. He felt slight soreness in groin, but continued working up to Sunday, when he noticed a swelling in the groin, and laid up. On Tuesday the testis commenced to swell. A fortnight ago he got up for two days, but had to return to bed on account of the left testicle swelling.

"The globus minor of the right testis was swollen, not hard, and

Charles W. Cathcart

there was evidently an inflammatory condition in process of resolution. The rest of epididymis, body of testis, vas, and cord were perfectly normal.

"He never mentioned the condition of the left testis until I observed it for myself. There was a similar swelling of the globus minor of the left epididymis, much firmer and more tender than its fellow. Neither body of testis, vas, or cord was in any way affected. And there can be little doubt that it presented the early stage of the same inflammatory process that was previously existent on the right side. There was no suspicion of any urethral discharge. The urine could not be examined. He was a leading light of his particular religious denomination, and was greatly offended at being asked certain questions, and in fact that he should be examined at all.

"CASE 2.—Man between 20 and 30, dock hobbler, on Wednesday, a fortnight before he came under treatment, as he was finishing work, threw down the chute and jumped sideways out of the way; in doing so he felt 'a twist on the right side of belly, passing round to the groin.' The following morning the testicle began to swell, and although he went to work the pain became so severe that he had to give up. The swelling is now subsiding and he has no pain. The globus major of the right epididymis was slightly enlarged and firm in consequence, but was neither stony, hard, nor craggy in feel. The rest of the testis was normal, as were the vas and cord, and there was no tenderness of the latter either in the scrotum or in the inguinal canal. The orifice of the urethra was perfectly healthy without the suspicion of a discharge. He complained of some tenderness over the lower part of the right side of the abdomen; there was no muscular rigidity. He resumed work in about two weeks after I saw him. No examination of urine was made."

In a note to this case Dr Grant adds the following details:—

"It happened as he was finishing work, he went straight home, had pain all the time, and although he made an effort the next morning to go to work, the testis was then swollen and too painful to allow him to continue. . . . In neither of my cases was there any ecchymosis to be made out."

The next case with similar causation and symptoms was reported by Mr R. E. Kelly,⁵ and throws valuable light on the etiology of the condition and on the after-effects on the testicle:—

" . . . Some authors have cast doubt as to whether torsion ever occurs in the normally descended testicle.

"My specimen, however, I believe to be a normally descended testicle. It belonged to a boy aged 19. Whilst at work he was lifting

Epididymitis, etc., followed by Tuberculosis

a very heavy sack of flour from a lorry on to a step some feet higher. Whilst the sack of flour was on his back, he turned sharply round and felt something 'give' in his left groin. This sensation was associated with a sharp, stabbing pain in his groin, which lasted two minutes. He was able, however, to continue at his work, and he was not seen at the Royal Infirmary until six days later.

"There was never any vomiting, and when admitted to the Infirmary, he showed a lump about the size of an orange in his left groin just about the external ring. The left part of the scrotum was empty, but the boy declared that he was absolutely sure that he had had previous to the accident a normally descended testicle, though he stated that it was somewhat higher on the left than on the right side.

"On exposure of the lump it was found to be a testicle. It was completely purple, on account of a hæmorrhagic infarction, and the tunica vaginalis contained a little straw-coloured fluid. The twist of the organ had occurred in the pedicle formed by the thinned-out attachment of the testicle to the peritoneal covering. It was entirely removed; for even in those cases in which the twist has been undone, the testicle either sloughs or atrophies.

"The testicle looks a fair size and, if we credit his statement, then it must have been in the scrotum before the accident.

"How then can one account for its torsion? I believe that this boy had a very roomy tunica vaginalis, that it must have extended up the cord in the form of a diverticulum in front of the external oblique; that it was, in fact, the shape of the peritoneal sac in the condition known as *hernia en bissac*, and that the strain had pushed the testicle from its normal resting place into this diverticulum, but in ascending into this situation it received its twist, which forms one complete turn."

The following case is reported by Barthélemy⁶ as one of torsion of the testicle. The condition in that instance was allowed to take its course to complete atrophy of the testicle:—

"C., aged 21, without personal or hereditary defect, no affection of genito-urinary system nor trace of any. Four years ago, Aug. 1907, in trying to step down from a foot-bridge he slipped, tried to recover himself, and immediately felt 'a stab in the right groin and scrotum.' The pain made him stop and rest for a few moments. With difficulty he got through the day, having only to keep his post at the bridge without any hard work. In the evening he noticed that 'the right part was a little swollen.' He returned to his post on the following day. Eight days later, the pain had increased by degrees, the pain was much worse. He decided to stop work and

keep in bed. He applied a leech to the scrotum which caused a slight hæmatoma which escaped without becoming infected. For three weeks the right side of the scrotum remained about the size of an orange, and was the seat of shooting pains. A doctor diagnosed orchitis and prescribed only rest in bed. The symptoms eventually subsided, the swelling disappeared, and he returned to work at the end of six weeks. Some time afterwards, not feeling his testicle in the scrotum, he thought that it had gradually returned into the abdomen as the result of his effort, and he said this when we first examined him (on 25th January 1911 for obstinate neuralgia of the cord). In the right side of the scrotum there was a testicle the size of a haricot bean. A normal left testicle."

The following case quoted by Lapointe⁷ has an important bearing on the present enquiry:—

"Obs. XXXI. Nanu. *XIII^e Congrès International de Médecine*, 1900, p. 401.

"Young man aged 19. Seen 15th November 1899. In going down a cellar heavily laden he suddenly felt pain in his left testicle. Before long the redness and swelling of the testicle made him go to bed. Having twice suffered in a similar way during the preceding year and always following an effort, he applied cold compresses, by means of which he had obtained relief before. On this occasion, however, the pain increased and he went into hospital.

"The local symptoms were such that an exact diagnosis was not possible. The pain increased and the temperature kept up.

"*Operation*.—On opening the tunica vaginalis I saw that the testicle was enlarged, dark red, almost black, and that the cord was twisted near the epididymis.

"*Castration*.—Examination by Babès. Abundant exudation in the interstitial tissue, which had caused necrosis of the whole of the glandular apparatus."

This case shows that torsion which has been brought on by a muscular strain may sometimes disappear spontaneously, and that when it persists the damage done to the glandular structure may render subsequent atrophy inevitable.

As an indication that the kind of case with which we are at present dealing is not so rare in general practice as might be supposed, I may conclude the series with three cases which Dr John Spence has met with and of which he has kindly sent me the notes for publication:—

Epididymitis, etc., followed by Tuberculosis

Three Cases of Acute Orchitis.

"1. W. B., 42, Schoolmaster. While boarding a car in motion almost missed his hold on the rail and made a violent effort to save himself. He succeeded in getting on, and after being seated for less than five minutes was seized with great pain in the left testicle and a dragging, aching feeling running up to the groin. On reaching home he found the testicle to be swollen and exquisitely tender. He was confined to bed for three weeks, and for the first four days had a raised temperature and nausea.

"2. A. J., 19, Lorryman. In assisting to unload a barrel of beer, which was to be run down a chute from the lorry into a cellar, the barrel suddenly slid and he jumped forward to grasp it. Almost immediately he became sick, with a severe pain in the left testicle and had to stop work. He was taken home, when it was discovered that the testicle was much swollen and very tender. Within an hour the skin of the scrotum was oedematous and of a dusky-red colour. He was incapacitated for a month.

"3. J. R., 22, Private, 5th Royal Scots. Cycled to General Post Office and back to headquarters, a distance of six miles. He had to carry the bicycle, to which was attached a fairly heavy mail-bag, up a flight of steps. He had no sooner done so, than he felt a sharp pain in the right testicle, accompanied by nausea and a fainting sensation. The pain soon travelled up into the groin, and on examination the testicle was found to be not only considerably enlarged, but so painful that patient could hardly bear to have it handled. Period of incapacity lasted nearly two months.

"In recording these cases special attention was given to ascertain any previous disease, especially gonorrhoea, and in none of them could any history of such be obtained. The subsequent course and mode of recovery bore this out."

It would not be difficult to multiply cases of this kind, but the fourteen cases now brought forward ought I think to justify the acceptance of muscular strain of the abdominal wall as the exciting cause of a sudden onset of acute orchitis and epididymitis, apart from either direct external injury or gonococcal infection. In other words, P.'s explanation of the cause of the acute orchitis from which he suffered is quite in accordance with the clinical experience of competent observers. This injury from strain, when the necessary conditions have been ascertained, seems to stand on an equal footing with other injuries from strain, such as the rupture of muscle, the tearing of ligament, or the sudden descent of a well-marked hernia in an apparently normal individual. When we come

to enquire into the mechanism of the injury two explanations arise out of a consideration of the cases dealt with in this paper, viz., Hilton's view that the vas deferens has been ruptured, and the view held by Barthélemy and others,⁸ that torsion of the testicle has occurred.

Although the passage of blood from the urethra with subsequent atrophy of the testis might be satisfactorily explained by a rupture of the vas deferens, it seems possible to explain these two phenomena also on the theory of torsion. In that case the torsion must have first caused venous congestion of the testicle severe enough to lead to blood effusion into the seminal passages and must afterwards have passed off so as to allow the effused blood to escape along the vas deferens into the urethra. Yet, after all, the evanescent torsion must have damaged the testicle so severely that atrophy was the result. One cannot speak dogmatically in favour of either view of Hilton's cases. Perhaps at a future date more light may be shed on the subject.

In Ker's case a blood-stained fluid escaped from the urethra shortly after the accident, but the testicle, instead of becoming atrophied, passed into a state of chronic inflammation. This can hardly have resulted from rupture of the vas deferens, and accords more with torsion, acting for a limited period.

A study of cases of torsion shows that while the condition is especially prone to occur when the testicle hangs abnormally free in the scrotum, it has been found in cases which at least present no abnormality to external examination. Moreover, although torsion may take place while the patient is sitting still, or even during sleep, it has most frequently been associated with exertion involving the abdominal muscles. Thus Lapointe⁹ in dealing with the immediate or determining cause of torsion of the testicle refers to the records of thirty-four published cases. Of these, six had no history of preceding traumatism or effort. In five of these six cases the affected testicle was intra-scrotal, and the exciting cause of the torsion, he thinks, was an action of the cremaster muscle. In nine cases no explanation of the torsion was available, but in the remaining nineteen cases the observers had recorded a determining cause. In some cases this was considered to be an effort to lift or carry a heavy weight. Sneezing, blowing a wind instrument, straining in defecation are referred to in others. Two patients suffered from torsion as they made a leap, another after a fall of several metres without any contusion of the scrotum. The various causes seem to act

Epididymitis, etc., followed by Tuberculosis

through the mechanism of an effort which involves contraction of the muscles of the abdominal wall. An inguinal testicle is then especially liable to be affected.

A local traumatism is given as cause in only one case of intra-scrotal torsion—the patient had squeezed his scrotum between his thighs in lifting a heavy wheelbarrow.

If torsion be accepted as the explanation of the greater number, if not all, of these cases, and if the cremaster be the agent responsible for the torsion, this view makes it easy to see why a severe abdominal strain may be the primary determining cause of torsion. The cremaster shares in the contraction of the internal oblique muscle, and a general venous congestion resulting from fixation of the diaphragm in a supreme effort would affect the pampiniform plexus. Dilation of the veins leading from the testicle, if it does not predispose to torsion, as some think it does, would at least aggravate the venous congestion which at once results from torsion.

The very rapid onset of testicular swelling has been a marked feature in many of these cases. In the absence of direct traumatism, torsion accounts very readily for this.

In the clinical histories of the fourteen cases to which I have called attention, the symptoms vary as to rapidity of onset, as to severity, and as to after-results. These variations may be explained by differences in the number of rotations which the testicle had undergone, in the permanency or otherwise of the torsion, and in the duration of the torsion when it had spontaneously disappeared. The symptoms of inflammation which have been observed would be due to the damage done to the tissues by the interference with its circulation. Although micro-organismal irritation is the commonest cause of inflammation, we need sometimes to be reminded that it is very far from being the only cause. Lister¹⁰ and Burdon Sanderson¹¹ taught us that long ago.

The next question is more easily answered—Could the orchitis and epididymitis which we have now accounted for have set up a tuberculous condition of the affected parts?

We know that a trauma from a blow or crush excites inflammation,¹² and this may stimulate a latent tuberculous focus into activity or, if there be no such focus present, lead to the development of a new focus. If that be true of inflammation from trauma it would doubtless be equally true of inflammation from torsion of the cord. In the latter case, the inflammation

would result from damage done to the tissues by interference with their blood-supply instead of from mechanical injury.

With regard to the interval of time between the injury and the formation of the tuberculous abscess, which was alleged at the trial to be insufficient, there is no difficulty if an existing tuberculous focus be assumed. Such foci are often unnoticed till they are of considerable size.

In the two following cases of rapid onset of tuberculosis of the testis after injury, the presence or absence of a latent focus is uncertain, and we may suppose it present, as it may have been in P.'s case :—

In November 1903, Antony R., aged 15, was admitted to Ward 18, Royal Infirmary, Edinburgh, suffering from a tuberculous right testis and epididymis.

History.—Five weeks previously, patient was walking in the street, when on turning round he was struck on the testicle by a potato thrown by some boy playing. Patient felt great pain and fell down and some boys picked him up. In about a quarter of an hour he felt all right and had breakfast. On returning to his work, patient again felt pain, but continued to work. He worked for two days, but after that went to Leith Hospital, where he was given a lotion and a suspensory bandage. The lotion did not lessen the swelling, but seemed to make it harder. Swelling then burst and pus escaped. . . . Three years ago he had hip-joint disease and some spinal trouble.

On admission the right side of the scrotum was swollen and red, and showed the healed scar of an abscess. The right epididymis was tender, and was hard and nodular below and fluctuating above. The apices of both lungs showed signs of tuberculosis.

The tuberculous testicle was excised. In this case within the five weeks' interval between the blow and the boy's admission to the Infirmary, a tuberculous abscess had formed, burst, and healed again.

Thomas J., aged 18, was admitted to Ward 18, Royal Infirmary, Edinburgh, 30th August 1911, suffering from tuberculous left testicle with sinus in scrotum. Twelve weeks previously he was struck on the left testicle with a bolt projecting from a hutch. That night the testicle swelled up and was so painful that he had to remain in bed for a fortnight. By that time the swelling had subsided and he returned to work, but in a few days swelling came on once more, accompanied with pain. This caused him to give up work in three weeks, and a fortnight later the swelling on the surface burst, and continued to discharge up to his admission. The pain, however, did not return.

In this case a tuberculous abscess burst about seven weeks after the injury, and was probably well advanced a week or two earlier.

Epididymitis, etc., followed by Tuberculosis

Supposing no focus to have been present in P.'s case, would four and a half weeks have allowed time for the development of a focus and for its resulting in abscess?

The following case recorded by Sir W. Watson Cheyne¹³ is the only one I can find in which an injury to apparently sound tissues has rapidly led to the formation of a tuberculous abscess.

"A female child, aged 5 years, with no phthisical history, no evidence of previous tubercular history, but with a strumous type of face, fell and struck the lower part of the sternum five weeks before admission. There had been no swelling or pain in the sternum before the accident. After the accident she began to complain of pain over the seat of the injury, and a swelling formed, evidently affecting both the bone and the soft parts over it. On incising the swelling a drop or two of thick pus came out. The thickened soft parts were dissected away, and it was found that the bone had become extensively softened and infiltrated with caseous material. In this case there was no mistaking the clinical appearances indicative of tubercular disease and the microscopical examination confirmed the diagnosis."

As the tuberculous nodule over the injured sternum was well formed and had attacked the underlying bone within five weeks of the injury, it must have been well advanced at least a week before that.

No doubt other similar cases of rapid tuberculous development after injury are to be met with in out-patient practice, but records of them are not easy to obtain.

The conclusions to which I think this study of P.'s case leads us, are as follows :—

1. Acute orchitis and epididymitis may be caused by a severe abdominal strain and may show itself by pain, swelling and discoloration within an hour or two of the onset.
2. This may occur without any gonococcal or other organismal infection of the urethra or of the parts affected.
3. It may occur without any apparent abnormality of the testicle.
4. The acute inflammation is sometimes at least the result of torsion of the cord induced by the strain, which possibly acts by exciting vigorous or irregular action of the cremaster muscle.
5. In some cases the inflammation may be caused, as

Hilton supposed, by a rupture of the vas deferens with simultaneous injury to the vessels and nerves of the cord.

6. The acute orchitis and epididymitis thus produced may end (*a*) in an active tuberculous affection of the epididymitis, either by exciting a latent focus of tuberculosis, or by giving rise to the conditions suitable for the development of a new focus; or (*b*) in complete atrophy of the testicle.
7. As a corollary to the possible presence of torsion of the cord in these sudden attacks of pain in the groin and testicle during muscular strain, it is advisable for the medical attendant 'to treat them as torsions of the cord unless he can be satisfied that no torsion exists at the time he sees the case.

REFERENCES.—¹ Clinical Lectures delivered at Guy's Hospital during the Winter Session, 1866-7, by John Hilton, F.R.S., arranged for publication by George Eastes, p. 16. ² Holmes' *System of Surgery*, 3rd edition, vol. i., "Injuries of the Pelvis," p. 934. ³ *Brit. Med. Journ.*, 13th April 1912. ⁴ *Ibid.*, 6th July 1912. ⁵ *Liverpool Medico-Chirurgical Journ.*, 1912, No. 62, pp. 394-7. ⁶ *Revue de Chirurgie*, 1912, p. 791. ⁷ *La Torsion du Cordon Spermatique*, Paris, A. Maloine, 1904, p. 153. ⁸ *Revue de Chirurgie*, 1912, p. 801. ⁹ *La Torsion du Cordon Spermatique*, Paris, A. Maloine, 1904, p. 47. ¹⁰ "On the Early Stages of Inflammation," *Collected Works*, vol. i., p. 273. ¹¹ Holmes' *System of Surgery*, article, "Inflammation." ¹² Monod et Terrillon, *Archiv. Gen. de Med.*, 1881, vol. ii., "On Contusion of the Testicle and its Consequences." ¹³ *Tuberculous Disease of the Bones and Joints*, 1st edition, 1895.

ADDRESS TO THE EDINBURGH OBSTETRICAL SOCIETY BY THE PRESIDENT,*

WILLIAM FORDYCE, M.D., F.R.C.P.E.

LADIES and GENTLEMEN, FELLOW MEMBERS OF THE EDINBURGH OBSTETRICAL SOCIETY,—I wish to preface the few remarks I have to make in opening the proceedings of another session by thanking you again very cordially for the high honour you conferred on me in electing me to the Presidential Chair. Very specially do I wish to thank my distinguished predecessor, revered teacher and very dear friend, Professor Sir Halliday Croom, for the all too generous terms on which he referred to me on the occasion of his valedictory address this time last year. It is no small distinction to be called upon by one's own colleagues to succeed the many eminent men who have held this position since the inception of our Society in 1840, and who, by their work and writings, have made the name of Edinburgh famous throughout the world in the departments of Obstetrics and Gynæcology.

A very deep sense of my own unworthiness and unfitness to follow in their train only makes my gratitude for this signal honour the more sincere, for I feel that I owe it to your goodwill and generosity, rather than to any service which I may have rendered to our special department of medicine. In expressing my warm appreciation of this mark of your esteem and confidence, I can only say that it will always be my earnest endeavour both now and later when I return to my seat in the ranks of the Fellows as an ordinary member—where, let me add, I shall feel that I am more appropriately placed—to do everything in my power for this Society of which we are most justly proud, and whose interests, I am sure, we all have very much at heart.

Since last we met in this hall one of our most distinguished Fellows has passed away. David Berry Hart, who died on the 10th of June last, was a most enthusiastic and tireless worker in the interests of this Society, which for the last forty years owes much of its high position and standing to his brilliant genius and unceasing efforts on its behalf. For it was through the medium of the published volumes of our *Transactions* that

* Delivered before the Edinburgh Obstetrical Society, 10th Nov. 1920.

William Fordyce

the greater number of his original, and in many cases now classical, papers were made known to the Obstetrical and Gynæcological world. I am sure, therefore, that you would wish me to take this first opportunity of expressing our warm and grateful appreciation of his life's work, and of the deep sense of loss which we, as a Society, have sustained in his death.

Born in Edinburgh on 12th October 1851, Hart was educated at our University, where he graduated M.B., C.M. in 1877. In the same year he was admitted a Fellow of this Society, and filled the office of Secretary from 1879 to 1883, and was President in 1890-1891. His connection with the Society, therefore, extended over the long period of nearly forty-three years. In looking through the volumes of our *Transactions*, I find that during this time Hart contributed to our meetings no less than seventy-two papers. The first of these, early in 1879, was entitled "A Study of Two Mesial Vertical Sections of the Female Pelvis in relation to the Normal Support of the Uterus and Prolapsus Uteri." It was at once a notable and highly original communication, and a presage of what our Society, and Gynæcology and Obstetrics, were destined to owe to his brilliant genius. Dr Angus Macdonald, in congratulating Dr Hart on his maiden appearance, expressed the hope that his paper was an indication of still greater promise for the further advantage of the Society. Professor A. R. Simpson hoped that this was the first of many essays with which Dr Hart would enrich the coming volumes of our *Transactions*. How amply these hopes have been fulfilled we all know. This was the *first* of a series of papers on the structural anatomy of the pelvic floor and its relations to parturition, intra-abdominal pressure, the rectal and vesical functions, and to prolapsus uteri, all of which threw a flood of light on subjects up to that time very imperfectly understood. Hart's views on these subjects, although perhaps held at the time to be somewhat revolutionary, if not erroneous, are now generally accepted by all gynæcologists and obstetricians. This part of his work did much to render possible the great and rapid advances in Perineal and Vaginal surgery generally, and in Cystoscopy in the female which took place in his time. He later applied the same methods of research and study, *i.e.*, by means of frozen sections, to the elucidation of some problems in connection with Advanced Extra-Uterine Gestation, and his paper read before our Society

Address to the Edinburgh Obstetrical Society

in 1887 on the Retro-Peritoneal form is now a classic and is constantly referred to in dissertations on this subject.

A fair review of all Hart's work, and of the many valuable contributions he made to Science and to Obstetrics and Gynæcology, in papers delivered before our Society, is beyond my power, even were it possible in the time at my disposal. I must, however, mention one or two in which he enunciated theories and doctrines which will always be associated with his name. In 1886 he read his paper "On the Nature and Cause of the Movement of Internal Rotation." His theory, based on his anatomical studies of the pelvic floor, that "whatever part of the foetal head or trunk first strikes a lateral half or lateral part of the sacral segment is rotated internally to the front," is now generally accepted in place of other theories based on the shape of the pelvis and shape of the foetal head. It is, moreover, the only theory which affords a rational explanation of the double rotation possible in right-occipito posterior cases.

His papers published in 1887, "A Contribution to the Anatomy of the Post-partum Uterus, with Special Reference to Placenta Prævia," and on "The Mechanism of the Separation of the Placenta during the Third Stage of Labour," and later in 1901 on "Uterine Retraction, with Special Reference to the Mechanism and Management of the Third Stage of Labour," will be in the memory of many of us for the very lively discussions and criticisms which they evoked. No subject, as Hart used to say, seemed to retain its perennial power of stirring members to eloquence as a discussion on the third stage.

I am sure he would have urged his theories on the mode of separation of the placenta in the third stage of labour even more insistently than he did, had the adoption of his views called for a new treatment; but both he and his opponents were agreed on this, that an expectant treatment during separation was best, that early and undue interference was bad, and at this he was willing to leave it.

Other striking and original communications were those on "Mitral Stenosis in Labour," and on the "Displacement of the Placenta in Extra-Uterine Gestation and its relation to those Cases ending in Pelvic Abscess," and on "Placenta Prævia." In 1895 we find the first of a series of papers on Embryology, dealing specially with the morphology and development of the genito-urinary tract, which presented a valuable contribution

William Fordyce

to the elucidation of many problems in connection with malformations and on so-called hermaphroditism.

In his later years he devoted himself largely to the study of Mendelism. We have the results in several learned and highly technical papers in our volumes. These papers, if somewhat beyond the understanding of most of us, never failed to impress his hearers with admiration for his industry and the fertility and versatility of his brain. His last paper, on "Puerperal Sepsis," was read to us in the year of his death.

Many of Hart's communications were, as I have indicated, controversial, and the discussions which they led to enlivened many of our meetings and prompted many other important papers in reply. In debate, and in the criticism of other papers, he was seen at his best. He had always a kind and encouraging word for the work of the younger Fellows; and while he was always ready to express his appreciation of good papers, he was outspoken and fearless in clear and incisive words in denunciation of what he considered erroneous or bad. While he may at times have given the impression of being somewhat intolerant and careless of the opinions of those who disagreed with him, this was but a mannerism, as no one welcomed more sincerely than he did intelligent criticism of his work. In his frank and outspoken criticism of papers, Hart set an example which I think might with advantage be more generally followed than is often the case in our meetings and discussions.

In addition to those numerous and valuable papers, Hart was joint-author of a text-book on Gynæcology and also wrote a book on Midwifery. The former, the famous Edinburgh *Manual of Gynæcology*, written in collaboration with Dr Freeland Barbour, was originally published in 1882, and marks a distinct epoch in British Gynæcology. This work may be said to be the first scientific text-book on Modern Gynæcology, and on it for several years many of its numerous successors were modelled. Embodying the views not only of the Edinburgh school, which the authors represented, but also those of America and the Continent, with a bibliography of recent literature on each subject treated, and with a wealth of illustration never previously attempted in any medical or surgical text-book, it was received among gynæcologists with acclamation and attracted again a world-wide attention to our medical school, which the names of Simpson, Syme, and Lister, among others, had already made famous. It ran through six editions, was

Address to the Edinburgh Obstetrical Society

translated into several languages, and was for many years the standard text-book in Gynæcology at home, in our colonies, and in America.

His *Guide to Midwifery* (1912) is in some respects, I think, an even more remarkable book than the *Manual of Gynæcology*. It bears the strong impress of Hart's originality and methods of teaching, and while never likely to be popular as a "cram" book, it will always make a strong appeal to the senior student and research workers in obstetrics, and to all teachers in this subject. It was at once a scholarly and able work, and never received the recognition it so richly deserved.

I have said enough, if indeed anything were necessary, to recall to your memory how much, as a Society, we owe to Berry Hart. His ideals of what such a Society should be, he stated at the close of his valedictory Presidential Address in 1891 in the following words: "Our special societies have a value that cannot be overestimated. Every such society should regard itself as a band of workers, or rather builders, whose duty it is, man by man, to contribute each his stone to the growth of its special science. We must resist the temptation to build more than our material warrants, and eschew all attempts to complete our ideas with tricked-out canvas, which must soon decay, and be torn down with reproach. It is given to few to make such gigantic contributions as Harvey, Simpson, and Lister, but most can at least add some fact, fill up some gap, and feel that their work, though humble, has been true,

"One stone the more swung to her place
In that dread Temple of Thy Worth."

How fully he realised those ideals by humble, strenuous, and honest work among us we all know, and I feel sure posterity will more fully appreciate.

A review of Hart's activities outside our Society is not called for here. It has already been given by Dr Ballantyne in his very scholarly appreciation which appeared in the *Edinburgh Medical Journal* last August. "He was remarkable," as another has said, "for his powerful virile brain, his inexhaustible energy, his buoyant disposition, and his scorn of all that was mean or savoured of quackery." And again, "He was gifted with a strong historic sense and a mathematical turn of thought, so that he brought to bear a vigorous, well-trained, and richly-stored mind on difficult problems, pursuing his subject with

William Fordyce

keen analytic force to a definite scientific termination. Thus he proved an indomitable searcher after truth, a powerful antagonist in debate, and knew no rest until he had substantiated his conclusions. His contributions to medical literature have left a European fame which will form his lasting monument." These words sum up far better than I can do myself what I would wish to say about Berry Hart. He was a great man, an honour to Edinburgh and our Society, and his place will be difficult to fill.

He was laid to rest in the Grange Cemetery on the 14th of June last. Many of our Fellows were present to pay their last homage of respect to his memory, and, in accordance with what I am sure would have been your wishes, our Secretary sent a memorial wreath on behalf of the Society. He also, in a letter to Mrs Hart and to the members of her family, expressed our affectionate sympathy in their bereavement, and our deep sense of loss in the death of our distinguished colleague.

The advances in Gynæcology since the foundation of our Society in 1840, and to which Hart in his day contributed so notably, have been phenomenal, equalled only perhaps by the rapid advances in abdominal surgery which, in turn, had its birth in, and developed from, an operation for the removal of an ovarian tumour by Ephraim McDowell of Kentucky in 1809. McDowell's association with Edinburgh is of historic interest. It is an oft-told tale, but I do not think it appears in our *Transactions*, so I take the liberty of repeating it.

Ephraim McDowell, of Scottish parentage, was born in Rockbridge County, Virginia, in 1771, and served his medical apprenticeship there with a Dr Humphreys of Staunton, who, we are told, was a practitioner of high standing and a graduate of Edinburgh University, and it was doubtless a love for and loyalty to his old *Alma Mater* that led to his pupil coming to Edinburgh in 1792 to complete his medical studies, instead of going to the University of Philadelphia, at that time the only seat of medical education in America. About this period, Edinburgh was attracting pupils from all parts of the civilised world, as it was justly considered the most famous medical school in Europe. McDowell spent two sessions at the University in Edinburgh, 1792-93, 1793-94, and his signature can still be seen in the Registration Roll of that time; and in the library day-book we have a record of the various books he borrowed for the purposes of his studies. These, we are told by Professor A. R.

Address to the Edinburgh Obstetrical Society

Simpson, who along with Dr Ballantyne looked up this matter, were for the most part connected with the subject of Chemistry. One of them, however, was a gynæcological text-book entitled *Hamilton on Female Complaints*. I have had this book in my hands, and it may safely be said that it was certainly not from this that McDowell received any inspiration for his subsequent classic operation. The surgical lectures in the Extra-Mural School, it seems, proved more attractive to McDowell than those delivered by the University Professor, and he took out the class of the celebrated John Bell in Surgeon's Square. Bell has been described as the most eloquent teacher and most gifted and able surgeon of that day. Professor Gross, McDowell's biographer, and who seems to have got most of his information from McDowell's nephew, writes:—

"It is difficult to conceive, at this distant day" [1862, only thirty years after McDowell's death] "the charm which this great teacher infused into his subject, and the ambition which he inspired in his pupils. All loved him; many worshipped him; not a few idolized him. Among the latter was the subject of this memoir. During his attendance upon his prelections, the young American was enraptured by the eloquence of his teacher, and the lessons which he imbibed, while thus occupied, were not lost upon him after his return to his native country. Mr Bell is said to have dwelt with peculiar force and pathos upon the organic diseases of the ovaries, speaking of their hopeless character, when left to themselves, and of the possibility, nay practicability, of removing them by operation. The instruction thus given made a powerful impression on Dr McDowell, which, as has been already stated, was not lost upon him after he took leave of the academic groves of Edinburgh." For some time before this the possibility of removing an ovarian tumour by operation had been attracting attention among anatomists and surgeons. Dr William Hunter, as early as 1762, while generally discouraging any such operation, cautiously adds, "If we could tell beforehand that the circumstances would admit of such treatment, the incision should admit only two or three fingers and the cyst tapped, that the surgeon may cut the pedicle without introducing the hand." Delaporte and Morand in 1774, in France, were bolder in their statements, while in 1798 Chambon, with almost prophetic vision, writes, "I am persuaded the time will come when this operation will be extended to more numerous cases than I have proposed, and

William Fordyce

that it will not be difficult to execute." In England, John Hunter in 1786, was the first decidedly to *advocate* the operation. He writes: "If taken in the incipient stage, they [hydatids of the ovary] might be taken out, as they generally render life disagreeable for a year or two, and kill in the end. There is no reason why women should not bear spaying as well as other animals."

Whether John Bell referred to these suggestions in his lectures we do not know, and the statement that he advocated the operation is made on the authority of McDowell's biographer, Professor Gross. There is certainly no reference to the subject in Bell's published works. In writing of tumours in general he *does* say: "... nor must you ever admit an unmanly fear of your reputation being involved in your patient's fate; but, when the patient is in danger of suffocation, you must not, you dare not refuse your help." In writing thus he may have had ovarian tumours in his mind, though the context hardly bears this out. A copy of the notes of John Bell's lectures would have great historic interest, but no such copy unfortunately exists as far as I have been able to find.

McDowell performed his famous operation, the first ovariectomy, in 1809, fourteen years after he had left Edinburgh and settled in Danville in America, and another seven years elapsed before he drew up a report for publication, by which time he had operated on two additional cases both also successfully. The strongest evidence we have that his achievement was inspired by his old Edinburgh teacher is the fact that at the same time he published his paper he sent a duplicate copy to Bell. His paper is entitled, "Three Cases of Extirpation of Diseased Ovaries." His nephew states that McDowell was very unwilling to publish any report at all, and was only induced to do so in order to show the debt of gratitude he owed to Bell, "and his obligation to compliment that celebrated surgeon with an exhibition of the exploits of his pupil in the execution of an operation, the practicability of which he had been at so much pains to teach in his lectures." Bell at this time was in Italy, where he remained till his death two years later in 1820. He never received the report. It fell instead into the hands of Lizars, who had charge of Bell's correspondence during his absence from Edinburgh. It remained in his possession unnoticed and unknown for seven years, till 1824, when Lizars published an account of an attempted ovariectomy by himself,

Address to the Edinburgh Obstetrical Society

and added McDowell's paper "seemingly in justification," as was said at the time, of what he considered a hazardous and dangerous operation.

McDowell's report of his historic operation and of the circumstances under which it was performed is so interesting and so brief that I give it in his own words:—

"In December 1809 I was called to see a Mrs Crawford who had for several months thought herself pregnant. She was affected with pain similar to labour-pains, from which she could find no relief. So strong was the presumption of her being in the last stage of pregnancy, that two physicians who were consulted on her case requested my aid in delivering her. The abdomen was considerably enlarged and had the appearance of pregnancy, though the inclination of the tumour was to one side, admitting of an easy removal to the other. Upon examination, *per vaginam*, I found nothing in the uterus; which induced the conclusion that it must be an enlarged ovarium. Having never seen so large a substance extracted, nor heard of an attempt or success attending any operation such as this required, I gave to the unhappy woman information of her dangerous situation. She appeared willing to undergo an experiment, which I promised to perform if she would come to Danville (the town where I live), a distance of sixty miles from her place of residence. This appeared almost impracticable by any, even the most favourable, conveyance, though she performed the journey in a few days on horseback. With the assistance of my nephew and colleague, James McDowell, M.D., I commenced the operation, which was concluded as follows: Having placed her on a table of the ordinary height on her back, and removed all her dressing which might in any way impede the operation, I made an incision about three inches from the musculus rectus abdominis on the left side, continuing the same nine inches in length, parallel with the fibres of the above-named muscle, extending into the cavity of the abdomen, the parietes of which were a good deal contused, which we ascribed to the resting of the tumour on the horn of the saddle during her journey. The tumour then appeared full in view, but was so large that we could not take it away entire. We put a strong ligature around the Fallopian tube near to the uterus; we then cut open the tumour, which was the ovarium and fimbrious part of the Fallopian tube very much enlarged. We took out fifteen pounds of a dirty, gelatinous-looking substance;

William Fordyce

after which we cut through the Fallopian tube and extracted the sac, which weighed seven pounds and a half. As soon as the external opening was made, the intestines rushed out upon the table, and so completely was the abdomen filled by the tumour that they could not be replaced during the operation, which was terminated in about twenty-five minutes. We then turned her upon her left side so as to permit the blood to escape, after which we closed the external opening with the interrupted suture, leaving out at the lower end of the incision the ligature which surrounded the Fallopian tube. Between every two stitches we put a strip of adhesive plaster which, by keeping the parts in contact, hastened the healing of the incision. We then applied the usual dressing, put her to bed, and prescribed a strict observance of the antiphlogistic regimen. In five days I visited her, and much to my astonishment found her engaged in making up her bed. I gave her particular caution for the future, and in twenty-five days she returned home as she came, in good health, which she continues to enjoy." The patient at the time of the operation was forty-seven years of age and died thirty-two years later.

This report seems to have attracted no attention at the time in this country. It was received in America with openly expressed incredulity and even ridicule. This is not to be wondered at. McDowell had done what had hitherto been taught by all surgeons to be impossible, or which no one if he believed it practicable had hitherto the courage to attempt, not even his old master and teacher, the distinguished surgeon John Bell who, we are told by Mr Miles, "was little disposed blindly to follow traditional teaching."

In the light of our present knowledge, and although we know that McDowell was recognised as a surgeon of great ability before he operated on Mrs Crawford, his achievement loses none of its greatness for its daring courage and success. Here we have a man in the backwoods of Kentucky, with no consultant to support him, without any trained assistant or trained nurses, without the aid of anæsthesia or antiseptics—instead an angry mob outside, as we are told, ready to hang the "Butcher" should the operation be fatal—putting to the test his firm conviction that ovarian tumours, the cause of untold suffering and final death to so many women, could be removed; and by his brilliant success confounding his elders in the Temple of Surgery, and so laying the founda-

Address to the Edinburgh Obstetrical Society

tion of all that abdominal surgery, since his day, has been able to accomplish.

It is good to think that Edinburgh has some small share in McDowell's glory, that, though he never took a degree here, he studied at our University and got the inspiration for accomplishing that on which his glory rests from an Edinburgh teacher.

That we have so little information regarding the two years he spent in our city is much to be regretted and is indeed surprising, for his biography was written some thirty years only after his death, and at a time when his fame was already assured. For the little we do know, we are indebted to his nephew Dr James McDowell, who was first his pupil and later on his assistant. Burns and Scott, he tells us, were his uncle's favourite authors. "In the reading of these," he says, "he rolled the Scottish idiom upon his tongue in a manner perfectly indescribable." We are told also that he sang a good Scotch song. His favourite pieces, I am glad to learn, were those of a comic and humorous character. The summer vacations he spent with two American class-mates in perambulating through the wilds of Scotland "much to their delight and edification," staying occasionally with friends (doubtless more often putting up at *Some Wee Hieland Inn*) and always being received with great hospitality and kindness. "His uncle frequently recurred," he continues, "in terms of greatest delight to the happy hours he spent in these peregrinations and ever after cherished a warm affection for the Scots, their beautiful and romantic country, and their noble scientific and charitable institutions." The following anecdote of his life in Edinburgh he often related with special glee. While he sojourned there a celebrated Irish foot-racer arrived, boasting that he could outrun any man in the city and bantering the whole medical class. McDowell was elected as their champion, the distance was sixty yards and the stake ten guineas; the trial took place in the College grounds, and the American purposely allowed himself to be the loser. A second race for one hundred guineas and at an increased distance came off soon afterwards, and this time the Irishman, after much bullying, was badly beaten, much to his own chagrin and the gratification of the students." Perhaps this same Irishman was one of the party of Irish medicals referred to in Lockhart's *Life of Scott*, who, in April 1794, made themselves so objectionable in the Edinburgh theatre by their revolutionary songs and insulting behaviour to all Loyalists in the boxes, and thereby incurred the

William Fordyce

displeasure of the young advocates and solicitors in Parliament House and their friends. These, among whom Scott was conspicuous, assembled in the pit one evening in force, determined to have "God Save the King" played without interruption and sung in full chorus by both company and audience. A stern battle ensued, we read, and after many a head had been broken the Loyalists at length found themselves in possession of the field. It is a fond imagination, but let us hope that McDowell was thus opposed a *second* time to the Irish athlete and was one of the five Loyalists who, along with Scott, were a few days later "bound over to the peace and obliged to give bail for their future good behaviour."

It has often been pointed out that in almost every sphere of human activity new theories, great discoveries, and epoch-making achievements, however important and valuable they may ultimately have proved to be, have rarely received immediate recognition, or their true value been at once realised. More often they have had to stand the brunt of much hostile criticism and violent opposition before their acceptance and adoption in practice. In medicine and surgery one has only to recall the names of Harvey, Jenner, Semmelweiss, Simpson, and Lister, and the great advances associated with their names, to realise how true this is. To these names that of McDowell must be added. For more than a quarter of a century after the report of his three successful cases was published, ovariectomy was condemned as an unjustifiable operation by practically all surgeons.

In this country, as I have stated, Lizars of Edinburgh in 1824 had attempted the operation seven years after he had received a copy of McDowell's paper. The patient was the subject of an abdominal swelling, which swelling was diagnosed by Mr Lizars and several other distinguished surgeons who had seen the case to be an ovarian tumour, but at the operation it was found that the supposed tumour was merely an accumulation of fat and of gas in the intestines. The patient, however, recovered, although we are told that each of the attending physicians in turn introduced his hand into the abdomen to satisfy himself that no tumour was present. Encouraged by the result (for according to all the accepted canons of the surgery of that day the patient should have died), Lizars in the following year, 1825, essayed the operation three times, but with very indifferent success. In two of the cases the operation had to be

Address to the Edinburgh Obstetrical Society

abandoned owing to adhesions, and one of the patients died. In the third case he was able to remove one diseased ovary but had to leave the other. This patient recovered, and therefore Lizars has the credit of being the first successful ovariologist in this country and in Europe. After this very qualified success, and mainly owing to the hostility and opposition of the surgeons in Edinburgh, the operation was not repeated in Scotland for twenty years, and then by Dr Handyside—also of Edinburgh. Handyside's operation was the subject of a paper read before the Edinburgh Medico-Chirurgical Society in 1846 entitled, "Observations on Ovarian Dropsy." This paper led to an historic discussion—historic because it was the first of many in Edinburgh on this same subject. As indicating the attitude of the surgeons of that day towards the operation, it is interesting to read that in opening this discussion at a special meeting set aside for this purpose, Dr Cormack claimed that all the great surgeons of the day denounced ovariectomy as an operation in almost every case unwarrantable, (1) because of the almost insuperable difficulties attending diagnosis; (2) because ovarian tumours are not fatal, and (3) because of the immense and inevitable dangers of the reparative processes. Sir James, then Dr Simpson, followed in what has been described as one of his "ablest and raciest speeches" in defence of the operation.

This was the commencement of a long drawn-out battle in private and on the floors of the Medico-Chirurgical and of our own Society between the obstetricians headed by Sir James Simpson and a few faithful followers on the one hand, and the surgeons of Edinburgh on the other who, along with Syme, were the most famous in Europe at that time. The opposition only began to die down when some thirty years later Dr Charles Clay of Manchester—an Edinburgh graduate and personal friend of Sir James Simpson—Spencer Wells, and our own illustrious Dr Thomas Keith had by their brilliant results firmly established the operation in surgery and so crowned the earlier efforts of McDowell.

The association of Edinburgh with the conception and execution of this the first and certainly one of the most beneficent of all abdominal operations may be only of sentimental and historic interest. In the defence and establishment of the operation it played certainly no small part, and this we owe chiefly to the genius and foresight of Sir James Simpson. In the elaboration and expansion of the operation the names of

William Fordyce

Thomas Keith and Lawson Tait, both Edinburgh men, will ever be associated.

Since the days of Ephraim McDowell, great strides have been made both in medicine and in surgery. Gynæcology, as we now understand the term, was then unborn. Now, with a literature of its own, it can show a record of progress and of work accomplished which, if not unequalled, is certainly not surpassed by any other specialty. Its later developments and most noteworthy achievements have certainly been along the lines of abdominal surgery as inaugurated by McDowell; but before these were rendered generally possible by the discoveries of anæsthesia and antiseptics, so that now McDowell's historic operation is the common and unnoted experience of every operating gynæcologist, it passed in its evolution through an important stage in which abdominal surgery played no part. This stage we are apt nowadays to overlook and underestimate, losing sight of those early pioneers to whom we owe so much in this department, and who laid the foundations on which we are now building. But for the work of these early pioneers Gynæcology would not have the importance it now possesses as an outstanding and highly specialised department. Among those early pioneers the names of two contemporaries stand out prominently—Marion Sims of America and our own illustrious early President, Sir James Y. Simpson. The introduction of Simpson's Uterine Sound in 1843 and of Sims' Speculum in 1845 gave an impetus to Gynæcology which can hardly be overestimated; the latter opened up a new era in operative vaginal surgery and the former a new era in gynæcological diagnosis, which must of necessity precede all rational and successful treatment. Together they aroused a fresh interest in the diseases of women, the diagnosis and treatment of which had made but little advance during the previous half century.

Before the use of the Sound was popularised by the publication of Simpson's paper, the affections of the uterus and the pelvic organs were detected and distinguished largely by the functional derangements and symptoms which they produced. How inadequate such symptoms are in the majority of cases for the purposes of correct diagnosis, and how symptoms alone are constantly liable to lead us into fallacy and error, we all know. And Simpson was the first to emphasise this. "They may enable us," he wrote, "to decide that the uterus is the seat of some morbid condition, but are inadequate to inform us what

Address to the Edinburgh Obstetrical Society

that morbid condition is." It is true that the gynæcologist of his day brought to his aid for the purpose of diagnosis the vaginal examination and the use of the tubular speculum, but in the absence of the bi-manual examination which was then not used the knowledge thus gained was very limited. By means of the Sound the field of examination was extended from the vagina and the os-uteri to the cavity and body of the uterus, the size and position of the uterus and its relation to other pelvic swellings could be at once determined, and it enabled the gynæcologist, and what is perhaps more important, it enabled the general practitioner to demonstrate, during life, certain conditions of the uterus which, though known before, had hitherto only been capable of demonstration in the post-mortem room. And the use of the Sound enabled him to correct or verify a diagnosis in many cases that had not before been possible. It is here, I think, that the importance and real significance of the *introduction* of the Sound to the profession by Simpson lies, for it must be remembered that Simpson did not *invent* the Sound, others before him had made use of a uterine probe; but his advocacy popularised its use as a means of diagnosis as nothing else could have done, and gave a new interest to Gynæcology in general practice, as did the introduction of the Sims' Speculum about the same time in America.

The use of the Sound as an aid to gynæcological diagnosis is now seldom called for. It has been largely superseded by the "Bi-Manual," and it has often been noted with surprise that Simpson did not recognise the value of this method of examination. He certainly was among the first to refer to it. In his memoir on the Sound, he writes as follows: "Provided the woman be not of a full habit and the abdominal muscles sufficiently relaxed by position, we can now pretty accurately examine with the hand placed on the hypogastric region, the state of the uterus as it is held forward on the end of the Bougie." And later in a paper on the "Detection and Treatment of Uterine Polypi," he refers even more pointedly to the examination by means of the combined use of the two hands. But he could not have seen the full value of this method of examination on which we now so largely depend for the purposes of diagnosis, or he would have been more insistent on its general employment. It may be that a proper appreciation of its value was only possible when abdominal section became a practical

William Fordyce

operation to every gynæcologist and rendered visible what previously it was only possible to feel.

Gynæcology, of course, owes very much more to Simpson than his introduction and popularising of the Uterine Sound. But I refer to this only as being the most outstanding and best-known of his contributions to the advancement of our knowledge regarding diseases of women, and as such, marking a distinct epoch in Edinburgh Gynæcology. His researches and numerous papers, in which he gave to the profession not only the benefit of his own wide experience but in which he also focussed the work of other workers in the same department in other countries, invested the subject of Gynæcology, hitherto quite neglected, with a fresh interest, and stimulated many others to work along the same lines. It was undoubtedly due to this awakened interest, and to the importance with which Simpson's work and genius had invested the subject, that we find in 1850 the Edinburgh Royal Infirmary Managers for the first time in this or any other country instituting a distinct gynæcological department and setting aside a number of beds for the diseases peculiar to women, and thus providing a means for clinical instruction in this subject. Dr J. Y. Simpson, as may be supposed, was appointed physician-in-charge. This is a very noteworthy incident in Edinburgh Gynæcology and has been referred to before by Sir A. R. Simpson, who pointed it out when the distinction of having been the first to set aside beds for clinical instruction in Gynæcology was claimed by Berlin. He showed that our own school in Edinburgh has the priority by two years, and remarked, "It was fitting that this should occur in the city whose Provost and Town Council more than half a century before had instituted the first of all the Professorships of Midwifery and Gynæcology."

Simpson lived to see the beginnings of what may be called Modern Gynæcology, for which his work in this department and the great part he took in the introduction of anæsthesia paved the way, and which was rendered possible only after Lister's discovery and its application to surgical practice. The growth and development of Modern Gynæcology is well reflected in the volumes of our *Transactions*, and we can, I think, look back with pride on the part many of the distinguished men whose names appear on the Roll of our Fellows have taken in its evolution and rapid advances.

It is difficult to foresee the future developments of Gynæ-

Address to the Edinburgh Obstetrical Society

cology. Its field of work is being encroached upon nowadays by the general surgeon ; but that it will cease to be a specialty and its practice pass into his hands, as some predict, I do not believe. That a surgeon can remove an ovarian tumour does not make him a gynæcologist, any more than the operation of some ardent gynæcologist who, in an emergency, extracted an aching molar, would ever qualify him in the estimation of his patients to practise dentistry. Many of the diseases peculiar to women can best be treated surgically, and will continue to be so treated. But Gynæcology has also its medical side. This side in the glamour of surgical achievement has been rather obscured and neglected, but its importance is now being forced upon us again by recent work in connection with the endocrine glands and the uses of radium, X-rays, and electricity in gynæcological treatment. A wide knowledge of every agency that acts on the female pelvic organs, either in the way of causing or of relieving disease, is as essential to the gynæcologist as mere operative dexterity. It behoves us to cultivate this wider outlook. So long as we do so, and so long as we can prove ourselves worthy of the heritage bequeathed to us by Sir James Simpson, the Keiths, Matthews, Duncan, Angus Macdonald, Sir A. R. Simpson, and Berry Hart, our Edinburgh School will retain the high prestige in the departments of Obstetrics and Gynæcology which its present position owes so largely to them.

CLINICAL RECORD

A CASE OF PAINLESS LABOUR IN A PRIMIPARA.

By G. E. W. HENDERSON, L.R.C.P. & S. Ed., Scone.

THIS case is of much interest owing to the fact that the three stages of labour were entirely devoid of pain.

The patient, Mrs A., a married woman, aged 23 years, and of somewhat slight build, is a farmer's wife and works hard. Throughout her pregnancy her health was excellent; she did a lot of dairy work, including the milking of several cows, right up to the morning of her confinement.

I was sent for by the nurse in charge at 3 P.M. on the 18th January, with the request that I would come as quickly as possible. I arrived at the house at 3.30. The patient was lying in bed, and expressed herself as feeling perfectly comfortable. On examination, I found, to my surprise, the head on the perineum, which was tightly stretched and bulging. The membranes were already ruptured, although neither patient nor nurse had noticed any escape of waters. The nurse informed me that at about 9 A.M. that day the patient had told her that she felt a "heaving" in her abdomen, associated with a feeling of "something pressing down." This "heaving" had come on at regular intervals, at first every half hour, but later at more frequent periods. It was getting so frequent that the nurse told her to go to bed at 2.30, and she then prepared to examine her, and was greatly surprised to find the head on the perineum.

The patient was lying on her left side taking an intelligent interest in our conversation. I placed my hand on the abdomen, and in a minute or two I felt the uterus contracting violently. The contraction was severe and prolonged, and was such as one would associate with that stage of a normal labour, except that, in this case, there was absolutely no pain. During the contraction the patient did not hold her breath. I repeatedly asked her whether she felt any pain at all, and she always replied that she felt nothing except a feeling "as if something was pressing down on the back passage," but no pain. The contractions were now coming on every three or four minutes, the perineum was very tightly stretched over the head, and looked as though it would tear. Another violent contraction came on, during which the patient said quite quietly, "That is a little sore, doctor; it feels as though something would tear." Wishing to save the perineum, I gave her a few drops of chloroform, and applied a cloth wrung out of very hot antiseptic lotion to the perineum. Another "pain" came

A Case of Painless Labour in a Primipara

on, and the head was born. The placenta came away itself twenty minutes later; again the uterine contractions were painless. The child was a full-time male, and weighed seven pounds. The presentation was an L.O.A. with a very well-pronounced caput succedaneum. The infant did not breathe for some minutes, and artificial respiration had to be applied for about five minutes, when he drew a long breath and began to cry lustily.

The case seems an unusual one. The mother is a perfectly healthy woman. Before her confinement she had the usual dread of the agonies of labour and was quite determined that she would insist on getting plenty of chloroform. Her nervous system is normal; reflexes present and normal. Sensation to touch, heat, and cold normal.

It is interesting to note that her entire involuntary muscular system does not contract in the same painless way her uterine muscle appears to do, as a dose of aloin sets up the usual painful griping, thus proving that the muscle in her intestinal canal conforms to the normal in this respect.

CRITICAL REVIEW

ANAPHYLAXIS IN MAN: ITS BEARING UPON HAY-FEVER, ANIMAL AND FOOD IDIOSYNCRASY, AND ASTHMA.

By CHARLES MCNEIL, M.A., M.D., F.R.C.P.Edin.

ANAPHYLAXIS, as at first studied, was a purely experimental condition. It consisted in the violent reaction of animal tissues to reinjection in small dose of a protein substance (generally innocuous) which on primary injection, even in considerably larger dose, produced no apparent ill effects. It was soon found to play a part in some disease processes in man. And it is now the subject of close and increasing investigation both in man and in animals, and is found to have wide bearings, not only in the production of certain diseases, asthma, hay-fever, the food idiosyncrasies, etc., but also in the reaction of the body to every sort of infection and as a stage in the production of immunity. It is the object of this review to consider side by side and in a broad way some experimental and clinical aspects of this difficult but important subject. The survey must be a very incomplete one, but some recent investigations both clinical and experimental, make such a survey worth attempting.

Historical Summary:—The name anaphylaxis, and the first experiment that clearly demonstrated it, come from France. C. Richet,¹ in 1902, was studying the toxic action of glycerine extract of the tentacles of certain sea-anemones. When a dog had received a small dose of this poison (congestin) without appreciable ill effects, the reinjection of the same dose twenty-two days later, was followed in a few seconds by general collapse, distressed breathing, urgent vomiting and diarrhoea, and by death in thirty minutes. To this reaction he gave the name "anaphylaxis," *i.e.*, something opposed to immunity. This term has been much criticised on the ground that anaphylaxis has now been shown to be a stage in the process of immunisation. But it is a stage that may be dangerous or fatal to the individual; and the term implies that, and yet also contains the root-word phylaxis. The name anaphylaxis is superior to any other used to describe the condition: to "allergy": to "hypersensitiveness," which is too general; and even to the old-fashioned term "idiosyncrasy," which, however, in its reference to a peculiar specific reaction shown by one individual is worthy of respect as an accurate term.

This dramatic experiment of Richet and the name he coined focussed attention on the mysterious paradoxical reaction, and further investigation brought further and more precise knowledge of it. It

Anaphylaxis in Man

was especially studied in the guinea-pig, rabbit, and dog, using, not toxic substances, but inert animal sera, especially horse serum.

In the guinea-pig, the intravenous reinjection of horse serum after a definite interval was followed by death in a few seconds from acute asthma and asphyxia—the Theobald Smith phenomenon.² This experiment proved to be the most extreme example of anaphylactic shock in animals: it has led to careful and fruitful investigation of anaphylaxis in the guinea-pig. In the rabbit another typical experiment was furnished by Arthus,³ who on repeated subcutaneous injections of horse serum, produced great swelling and even sloughing and ulceration at the site of reinjection—the Arthus phenomenon. In the one experiment we have a general anaphylaxis, a condition of hypersensitiveness widespread throughout the body: in the other, a local and focal anaphylaxis, a hypersensitiveness of the tissue to which the sensitising agent is applied. These two type experiments are more than important landmarks in the historical development of the subject: they are factors of varying importance in most clinical conditions of anaphylaxis.

Experimental Anaphylaxis.—This may be induced by a large number of substances, inert or toxic, but only under definite conditions. The substance must be of protein composition; it must reach the body either by a parenteral route, or at least escape the action of the digestive juices; it requires time for its development, and farther injection within this period of incubation may prevent its appearance; it is specific and only elicited by the exciting or sensitising injection of the original substance, though often in extremely small amount: it lasts for a long time, often during the lifetime of the animal, and may be transmitted to its offspring. Dale,⁴ who has taken a distinguished part in the investigation of the mechanism of anaphylaxis, has summarised present knowledge in his recent Herter lectures (1920). Dealing with anaphylaxis in the dog, cat, rabbit, and guinea-pig as induced by normal horse serum he shows that there are two main effects in the anaphylactic state, a depression of the capillary tone, the result of injury to capillary endothelium, and an increase of the tonus of plain muscle throughout the body. These two morbid factors vary in their intensity and in their distribution in these different animals; but both take place, though to a varying extent, in them all. Thus the guinea-pig dies of acute suffocation because of intense constriction of the bronchial muscle, owing to the peculiar anatomical conditions of the mucous membrane in the guinea-pig readily producing complete obstruction of the airway. In the rabbit, death from anaphylactic shock is due to acute distension of the right heart (Auer), this distension being due, according to Coca, to constriction of the arterial muscle of branches of the pulmonary artery. In both these animals,

depression of capillary tonus is in play, but is a secondary factor and is not a cause of death. But in the dog, and also in the cat, a general capillary engorgement and arterial depletion take the first place; tonus of plain muscle does occur but is of secondary importance. In the case of the dog, the capillary circulation of the liver is especially depressed; and if the liver is excluded from the circulation, fatal anaphylactic shock is prevented in the dog.

Other writers have alleged sensitisation of the nervous system, central or peripheral, in anaphylaxis: and the fact that anaphylaxis may be modified or prevented by anæsthesia, by chloral or by atropine, seems to support this view. It is curious and significant that this effect of anæsthesia, etc., is absent in the anaphylaxis of dogs and cats, *i.e.*, in animals where tonus of plain muscle, though present, is not a fatal factor: while it operates in guinea-pigs and rabbits when this muscular tonus is primary, extreme, and the cause of death. The involvement of the nervous system in anaphylaxis is however still unsettled.

It is stated also by writers on the subject that there is sensitisation of epithelial cells of the skin and mucous membranes in anaphylaxis: but here it is difficult to separate the effects of lesions of capillary endothelium with resulting congestion and œdema, from an independent alteration in adjoining epithelial layers. This question also may be left in doubt in the meantime.

There remain, then, as well-grounded facts of anaphylaxis induced in these animals by horse serum, an action upon capillary endothelium varying in its distribution and intensity in different species, but resulting in loss of capillary tone, in capillary engorgement, in œdema and extravasation; and a tonus of plain muscle, bronchial, gastro-intestinal, arterial, uterine, varying again in its distribution, degree, and effects in these different animals.

These examples of experimental anaphylaxis are extreme. Fatal experimental anaphylaxis is easily produced when the exciting injection (injection déchainante of Richet) is intravenous; it is often avoided if it is subcutaneous. Alimentary anaphylaxis, produced by ingestion of protein, is extremely difficult to produce.

Dale makes a further interesting and almost startling contribution to this subject of experimental anaphylaxis. With histamine in single intravenous injection, an amine derived from ergot by decarboxylation of amino-acids, he has produced these two main effects characteristic of acute fatal anaphylaxis, marked capillary engorgement and tonus of unstripped muscle, *and has produced them in the same differences of degree and distribution as they occur in anaphylaxis in these different animals.* This makes it at least a fair hypothesis that the tissue-changes in anaphylaxis are due to some cleavage product of body protein akin to or identical with histamine.

Anaphylaxis in Man

It is outside the scope of the present paper to discuss the relation of anaphylaxis to immunity. The connection is close though difficult to elucidate, and its bearing upon practical medicine and especially upon the improvement in our methods of prevention and treatment of infective diseases is also direct and important. The above very brief and imperfect account of experimental anaphylaxis is given as an introduction to the consideration of certain forms of anaphylaxis as they occur clinically in man. These clinical types are serum-disease; the inhalation anaphylaxis group (hay-fevers, animal asthmas); the ingestion group (food-idiosyncrasies, etc.); and spasmodic asthma, and asthmatic bronchitis. In human anaphylaxis the conditions are different and much more complicated than in the animal experiment, and the mysterious factor of heredity not seldom comes into play. But in man, under natural conditions of life, there may, and does occur, that conjunction of events necessary as we have seen in an animal to complete the artificial anaphylactic experiment, the first passage into the blood of undigested or incompletely digested protein, a definite interval, and then the second passage with the detonating result. It can be shown that in man, under natural conditions, the anaphylactic reaction does show these two main effects characteristic of animal anaphylaxis—an injurious action upon capillary endothelium, and a spasm of non-striated muscle, especially of the bronchial muscle, with minor differences of degree and distribution and effect. The special grouping of activating causes is the same; the reaction is fundamentally the same, whether in dog, or guinea-pig, or man. It is a biological reaction common to the important mammals.

SOME CLINICAL TYPES OF HUMAN ANAPHYLAXIS.

Serum Disease.—This is the symptom-group following the subcutaneous injection of antitoxic serum, usually of anti-diphtheritic serum (horse). Where two such injections are given with a suitable interval, the conditions closely conform to those of an animal experiment, so that this form of human anaphylaxis may be suitably considered at the outset. In the first place it should be said that serum disease is not in any way due to the antitoxin in the serum; it is produced equally typically by normal horse serum.

V. Pirquet and Schick¹⁰ were the first to describe the symptoms of the disease, to relate them to the subcutaneous injection of serum, and to definitely group them as phenomena of anaphylaxis or allergy. E. W. Goodall⁵ has carefully described and analysed a large number of these cases occurring in course of the antitoxic treatment of diphtheria. In about 200 cases of reinjection in cases of relapse or second attack (interval two weeks to thirteen years) serum disease of severe type occurred in 56 per cent., the symptoms being fever and malaise,

urticarial rash and arthritis, and usually developing in from eight to sixteen days after reinjection. But many of the cases showed a shortened incubation period (one to six days) as well as a sharper type of illness—the “accelerated reaction”; while a few became extremely ill in from a few minutes to six hours with high fever, rigors and collapse, rapid appearance of rash on skin and mucous membranes, and convulsions—the “immediate reaction.” Scattered through the literature, isolated cases of death from the “immediate reaction” are reported; also symptoms of asthma and hay-fever are noted in many reports of serum disease.

Serum disease in the conditions under which it develops in man is the nearest thing we have to horse serum anaphylaxis in animals. In man death is much rarer than in animals, and the effects otherwise may appear different. But in man there is clear evidence of local and general action upon capillary endothelium, and also some evidence of tonus action upon the bronchial plain muscle. It is worth noting that in the severe cases of “immediate reaction” the general cyanosis and collapse indicate a marked depressor action on capillaries, while evidence of acute asthma as produced by tonus of bronchial muscle is lacking. We may say, then, that acute anaphylactic shock in man resembles that in the dog; it differs from that in the guinea-pig.

The exaggeration of the anaphylactic phenomena of serum disease in the “accelerated” and “immediate reactions” is interesting. Its explanation is unknown, and it need not be further discussed here. But it is tempting to compare it with the fulminating types of certain infectious diseases, *e.g.*, scarlet fever, measles, pneumonia, etc., where there occurs also great shortening of the incubation period, and great intensification of the symptoms with cyanosis and collapse.

Cases of serum disease following a first injection of antidiphtheritic serum are difficult to explain. Goodall found them in about one-third of the cases injected, and the symptoms were more trivial though of the same general character. He hesitates to describe them as instances of anaphylaxis. It will be shown later that heredity plays an important part in human anaphylaxis, and it may have some influence here. Some of the cases also may have a previous idiosyncrasy to horse. Apart from such cases they do not conform to the conditions of anaphylaxis. Until we have fuller knowledge they may be left in the limbo of unclassified phenomena.

Inhalation Anaphylaxis.—I have used this phrase in order to bring into one group several types of disease in man now regarded as anaphylactic. These are the varieties of pollen fever (early and late hay-fever, etc.), and the various animal asthmas (horse, cat, bird, etc.). They show marked resemblances in clinical features, and they are all immediately caused by the inhalation of fine particles, vegetable or animal.

Anaphylaxis in Man

The symptoms are, rapid swelling, with redness and irritation of the nasal mucous membrane and conjunctivæ, sneezing and lachrymation, great discomfort in breathing, and fever; very frequently there is asthma, and of severe type; also urticaria. So that in this syndrome we have local and focal sensitiveness generally of high degree—a striking clinical example of the Arthus phenomenon; and also tonus of the bronchial muscle. In fact we have, with a distinctive emphasis and grouping, that action upon capillary endothelium and upon unstriated muscle characteristic of experimental anaphylaxis in animals. But inhalation anaphylaxis is predominantly a focal disease; the general reactions of asthma and urticaria are later in time, and as a rule of minor severity, though here there are striking exceptions.

Freeman⁶ has, in a recent paper, dealt with this and other clinical groups of "toxic idiopathy" (he objects to the term anaphylaxis) in a most illuminating way. He emphasises the following points: hay-fever or pollen-fever is in this country due to grass-pollen; the other pollens may, but practically do not, cause disease. But in America we have, in addition to hay-fever (June fever), produced by grass-pollen, a numerous group of late hay-fever cases, produced by certain flowering compositæ (ragweed, golden-rod, etc.). There is local sensitiveness, as above described; but the whole body surface of skin and mucous membrane is potentially sensitive, and experimentally and at any season of the year the skin or the alimentary tract can be shown to react if the specific dried pollen is brought in contact with the superficial circulation. Further, in marked cases of hay-fever, this experimental cutaneous reaction is often positive for a number of other pollens, though in lesser degree; though it does not necessarily follow that the symptom complex of hay-fever will be produced by the inhalation of these other pollens.

Animal asthmas are much rarer: they, too, are produced by inhalation, and they show the same symptom complex, and the same general sensitiveness of skin and mucous membrane under suitable experimental or natural conditions. He gives a most interesting photograph of a series of positive cutaneous reactions produced in a horse-asthma patient by six sera from various members of the Equidæ. In the case of horse asthma, it is the horse dandruff in fine particles that usually excites the disease; but dried horse-dung will act in the same way, and any kind of dried horse-tissue. So for the other animal asthmas, it is usually the fur or feathers in fine division that produce the disease; but any tissue of the specific animal, bone, blood, muscle, etc., is equally able to do so.

The Factor of Heredity.—Freeman gives diagrams of family histories to show that heredity plays some part. These show not only that hay-fever tends to run in the same families; but also that animal

asthma also does so, and in the same families as the hay-fever cases. This factor of inheritance is mysterious; it has been demonstrated in animal anaphylaxis, and established also beyond doubt in man where it contributes its influence in a large number of the cases. Cooke and van der Veer⁷ have made a very careful investigation of 621 cases of human sensitisation, chiefly in hay-fever cases. In 504 cases where a complete family history was obtained, a positive history of sensitisation in an ancestor, either direct or collateral, was obtained in 48 per cent. The amount of their material and the care with which it has been collected and analysed give great weight to their conclusions. There is not, they say, the transmission of a definite specific sensitisation from parent to child; but what is transmitted is *the capacity or tendency to form specific antibodies to any form of protein*. In other words, the children of a sensitised parent are not born sensitised, but they acquire any anaphylaxis more readily than do other children; and the more complete the inheritance, the earlier in life do they tend to acquire and show some clinical form of anaphylaxis.

Multiple Sensitisation.—This is exemplified in cases where a hay-fever patient suffers from both the early and late variety; or also from an animal asthma or a food idiosyncrasy. It seems probable that the influence of heredity is also at work here, combined with the accidents of sensitisation. These individuals are especially apt to acquire an anaphylaxis, and they often acquire more than one. The facts of multiple sensitisation, given by Cooke and van der Veer, are beyond dispute. Of 551 cases of anaphylaxis (including 530 cases of hay-fever), 42 per cent. showed *clinical evidence* of multiple sensitisation. Most of these were double sensitisation to early and late hay-fever; but there were 42 cases (7·6 per cent.) with 3 sensitisations, and 19 cases (3·5 per cent.) with over 3 sensitisations. These included 37 sensitive to horse, 35 to strawberry, 28 to shellfish, and 27 to fish. The same essential facts are shown in a most clear and convincing way by Freeman's family history diagrams. He states that nearly half of his horse-asthma patients also suffered from hay-fever; and that one "toxic idiopathy" may die out and be succeeded by another.

Ingestion or Food Anaphylaxis.—Idiosyncrasies to certain foods, shellfish, fruits, etc., have been known long before Richet made his experiment and gave it the name anaphylaxis. They are very uncommon, but are so striking as to force themselves dramatically into notice. The cases show local and focal sensitisation of the alimentary tract, œdema of the mouth and lips, urgent vomiting and diarrhœa; and as secondary but still important symptoms, urticaria and asthma. Apart from the different site of the focal reaction, the tissues morbidly affected (capillary endothelium and unstriped muscle) are the same as in the animal and vegetable idiosyncrasies of the inhalation group; they

Anaphylaxis in Man

also tend to run in families, and, as has just been shown, in the same families as the hay-fever and animal asthma patients, and they occasionally appear in the same individual.

Freeman points out that food idiosyncrasies of minor degree and trivial symptoms occur. Here the local reactions may be slight and overlooked as a vague dyspepsia, while the usually secondary symptom of asthma may take its place in the foreground.

As a group of food anaphylaxis distinct from the above, we have the cases of sensitiveness to common foods, cows' milk, eggs, cereals. These are found in infants and young children and appear soon after these foods are first taken. Schloss⁸ has written recently a valuable account of this subject. He says that cases may be congenital or acquired, and that it is often difficult to exclude the important and frequent factor of heredity. But he gives an account of five cases observed by himself where it seemed certain that anaphylaxis to egg-white and cows' milk had been acquired during attacks of diarrhoea. He describes the following clinical types of anaphylaxis in infants and young children: a hyperacute type with urticaria, asthma, and symptoms of shock, most commonly due to milk or egg; bronchial asthma; urticaria; angioneurotic cedema; erythema multiforme; and eczema. The subject of food anaphylaxis in infants and children is comparatively new, but it promises to become important. In the case of foods commonly used, it seems probable that continued use of the food in spite of symptoms will rapidly lower and then abolish the sensitiveness of the patient.

Spasmodic Asthma and Asthmatic Bronchitis.—We are now in a position to discuss asthma as it occurs in man, exclusive of renal or cardiac asthma. In the experimental anaphylaxis of guinea-pigs, the cause of death in the fatal form of shock is acute asthma and suffocation produced by tonus of the bronchial muscle. In the forms of human anaphylaxis discussed in the present review—serum disease, hay-fever, the animal and the food idiosyncrasies—asthma has in them all an important place in the symptom-complex. Where the other symptoms of the group are present, the cause of the asthma is easy to find. But cases occur where the other local symptoms are almost masked, while asthma may stand out as an apparently independent and solitary symptom—as the disease. It is in such cases that this new knowledge of anaphylaxis is of value, giving a new and definite standpoint from which to approach the clinical problem of asthma. We can now ask several pointed questions, and we have precise methods in finding the answers. Is the asthma an expression of anaphylaxis produced by a vegetable pollen, or by animal particles, or by ingestion of some special food? The clinical history showing incidence of the symptom with the grass-flowering season, or closely

following contact with some animal, or after eating some particular food, may furnish a clue. That clue may then be followed up by a cutaneous test with the suspected material, pollen, horse-dandruff, or food substance, and if this is positive, the cause of the asthma has been discovered. Walker⁹ has studied 400 cases of asthma in this way: 191 were positive to the cutaneous test, 92 to pollen, 78 to animal hair, 68 to food, and 33 to bacteria. Many patients reacted to more than one protein. He obtained no positive cutaneous reactions in patients over 50 years of age. He expresses the belief that in infancy many minor bronchial disturbances are really of asthmatic nature and are due to some form of food sensitisation, and later become typical cases of spasmodic asthma; and again that the younger the age of incidence of asthma, the more likely is it to be due to a food protein anaphylaxis. His cutaneous tests in cases of early age incidence of asthma showed a high proportion of positive reactions to food protein, in infancy especially to egg, milk, and cereals, and in later childhood especially to fish, meat, and potato.

It is necessary in the meantime to be cautious in accepting the solitary evidence of a positive skin test as a proof that this particular protein is a cause of disease. Accompanied by clinical evidence, it is of great value; alone, it is doubtful.

There remains the question of bacterial infection as a cause of asthma, in relation to asthmatic bronchitis. That it can do so, is suggested not only by cutaneous tests (not in itself a proof), but by the cure of the condition by vaccines. Freeman quotes a case where bacterial infection at a site remote from the respiratory tract—a pyocyanus infection of the lower bowel—was a cause of spasmodic asthma.

But the relation of bacterial infection to asthma requires to be treated with caution: for a bacterial lesion of the body surface leaves the possibility of entrance through this abraded surface of non-bacterial protein and the production of anaphylactic phenomena by non-bacterial protein. If this is true, bacterial infection would be a contributory but not an immediate cause of asthma, and its removal by vaccine or other treatment would not be a proof of its immediate agency in the disease. The occurrence of asthma in the cold seasons of the year and associated with bronchial catarrh is suggestive evidence of bacterial infection as a factor, and an indication for vaccine treatment. These recent advances in knowledge place the physician in a much stronger position with regard to asthma. Its etiology can now be explored along definite directions and by precise methods; and further investigation may show that asthma, occurring alone as an isolated clinical phenomenon, is in the majority of cases an anaphylactic reaction and due to the entrance into the body of some specific

Anaphylaxis in Man

protein, of animal or vegetable origin. The number of such substances is very great; and in conditions of disease the opportunities of their passing into the body behind or through the defence of the machinery of digestion are numerous.

This account of some anaphylactic phenomena in man is very incomplete. The subject is both wide and intricate; it is full of controversial questions, and it is not an independent thing, but vitally bound to the subject of immunity. But these clinical conditions that have been treated in the present paper seem to be linked to one another and to certain phases of experimental anaphylaxis by resemblances in the conditions of their causation, in their pathology and their clinical symptoms. It is hoped in a future paper to return to the subject and to deal with the cutaneous tests and the specific treatments for hay-fever, the animal and food idiosyncrasies, and asthma.

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OBITUARIES

J. W. SIMPSON, M.D., F.R.C.P.E.

ON the morning of 11th January the profession was stunned by the news of the death of Dr J. W. Simpson, who after an illness of only a few days had succumbed to an attack of influenzal pneumonia. In July of last year he had undergone a serious operation, but he had made an excellent recovery and had fully regained his accustomed vigour and buoyant spirits.

Dr Simpson, who was forty-eight years of age, was a son of the Manse and was educated at Dollar Academy and at Edinburgh University, where he graduated as M.B., C.M., in 1896, and as M.D. in 1906. He became a Fellow of the Royal College of Physicians in 1903. Very early he specialised in the Diseases of Children, and his services as a consultant were in great demand in Edinburgh and the country. After occupying several important Resident and other posts in his specialty he was appointed Extra Physician to the Royal Hospital for Sick Children, and in due course was promoted, till for some years before his death he had been one of the Senior Medical Officers. His loss to that Institution will long be deplored by his colleagues and by the Directors. From time to time he contributed interesting original papers on the maladies of children to different journals, and his *Guide to the Feeding of the Infant during the First Year* enjoys a wide circulation.

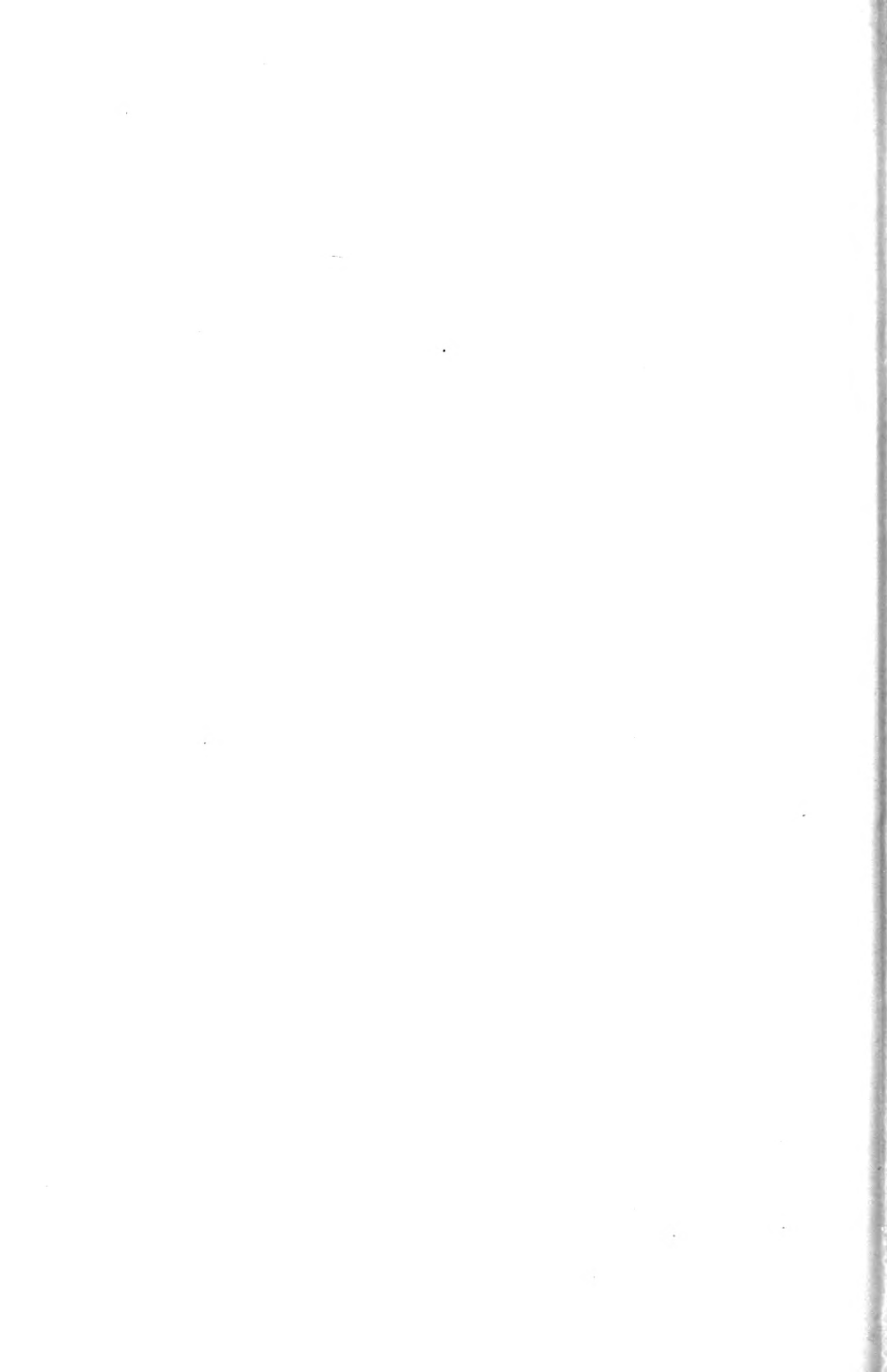
Jack Simpson, as he was familiarly called by everybody, could ill be spared, and his death is an irreparable loss to the profession and to a very large circle of friends and patients. He was beloved by everyone and won the esteem and the confidence of all. He deservedly enjoyed a large and ever-increasing practice, for he undertook his daily work with characteristic enthusiasm, meeting with corresponding success. He proved himself an excellent family doctor; he was a sound and careful physician, while his cheery optimism did much to brighten the sick-room and to alleviate anxiety. He possessed to an exceptional degree those qualities of heart and head that tend to make the successful practitioner. He considered it his duty to shoulder the responsibility of the illness, and



Photo by]

[J. Swan Watson

THE LATE J. W. SIMPSON, M.D., F.R.C.P.E.



Obituaries

only when real danger arose did he share it with the relatives of his patient.

Much as he will be missed by many as a physician, many more will feel they have lost one of the best of friends. Jack Simpson had by nature the faculty of endearing himself to everyone who met him. His open, frank disposition appealed at once to the stranger, and ever retained the affection of his friends. He was especially fond of all games and sport, and perhaps he was seen at his best on holiday, when a no more delightful companion could be wished. He was a keen fisherman during his vacation, and when at home he found time to indulge in golf, and many will recall his enthusiasm and his enjoyment of the game. He was an energetic member of the Medical Curling Club, and had become quite an expert on the rink. Earlier in life he was a really great football player, and took part in no less than thirteen "internationals." His interest in the game never flagged, and at one time he was President of the Scottish Rugby Union Committee. Jack Simpson lived as a sportsman, and he died as a sportsman without a murmur of complaint or grievance. He will never be forgotten by those who knew him.

The funeral took place on 14th January at the Dean Cemetery, and was attended by a very large number of professional and other friends. Much sympathy is extended to Mrs Simpson and her boy in their terrible loss.

J. L. L.

The loss which the Sick Children's Hospital has sustained through the sudden death of Dr J. W. Simpson is very great. It is not too much to say that he was universally beloved. He had the great virtue of simple candour. When he took part in discussion his hearers instinctively knew that he was speaking what was in his mind without any concealment of his thoughts. And as his thoughts were kindly, his judgments charitable, his opinions moderate, and his acts unselfish, his frank outspokenness never offended, but gained him friends. His simplicity of character, an equable cheerfulness, a sense of the ludicrous, and above all his unswerving loyalty and sincerity, made his companionship welcome and his friendship prized. His native courtesy and considerateness quickly placed strangers on the

Obituaries

footing of acquaintances, and with Simpson acquaintance soon ripened into something more intimate and cordial.

An excellent clinician and teacher, he was modest almost to a fault, and more than generous in his appreciation of the work of others. He carried into his profession the same enthusiasm as he did into his recreation: and with the same result. One could no more conceive his being careless in a diagnosis or in handling a patient than being slack on the links. His was essentially a practical mind, and whatever he did he did well. Simpson was attached to the Staff of the Hospital for seventeen years, and not one of his colleagues would wish any act of his in these years undone, or word unsaid. They greatly cherish his memory and bemoan his untimely death.

WILLIAM LATTO ROBERTSON, M.B., F.R.C.S.E.

WE record with great regret the death of Mr Wm. L. Robertson of Dundee, as a result of blood poisoning contracted a few days before in the course of his professional work. Mr Robertson was well known in Edinburgh, where he graduated M.B., Ch.B. in 1905, and became a Fellow of the Royal College of Surgeons two years later. In the interval he held a number of Junior Surgical posts in the Royal Infirmary, the Royal Hospital for Sick Children, and the Chalmers Hospital. He then joined the Dundee Medical School and gradually made for himself an outstanding position among the younger surgeons. He served throughout the war with great distinction; was twice mentioned in despatches and awarded the Military Cross.

If anything could add to the tragedy of Robertson's death, it is the fact that he had just entered into the fruits of his labours when he was cut off, having recently obtained full charge of wards in the Royal Infirmary and in the Victoria Hospital, and entered upon his duties as Lecturer in Clinical Surgery in the University of St Andrews.

His winning personality, no less than his professional attainments, endeared him to his contemporaries, by whom his loss is keenly felt.

NEW BOOKS

Instinct and the Unconscious. By W. H. R. RIVERS, M.D., D.Sc.,
F.R.S. Pp. vi + 252. The Cambridge Medical Series.
Price 16s. net.

The validity of Freud's doctrines has been tested from many sides—from that of clinical medicine, of ethnology, of sociology, etc. Dr Rivers has made it his special province to do so from the side of comparative and developmental biology; and his studies in this respect form the chief theme of the present book.

The main Freudian doctrine is that of suppression—the sexual theory being a mere accident, which might disappear without the general body of Freud's teachings being much affected. Dr Rivers shows that suppression should be regarded as an instinctive process. He puts forward the view that instincts have as a characteristic feature the “all or none principle,” though this becomes modified later by the wider choice of reaction, which the growth of intelligence allows. In their primitive form, however, the instincts could not attain their full usefulness unless there were complete suppression of modes of reaction other than that selected. Thus the reaction of immobility to the emotion of fear entails that the reaction of flight be absolutely suppressed. The slightest manifestation of the latter would altogether ruin the former. Later, with more advanced intelligence, a partial reaction may, in suitable circumstances, serve the protective purpose; and it is suggested that hysterical paralysis may in this way be an example of a partial reaction of immobility to the emotion of fear, a reaction in the circumstances quite suitable, since it will serve to keep the patient out of danger. The early primitive, all or none reaction, Dr Rivers calls *protopathic*, the later, discriminative reaction he calls *epicritic*.

While such an explanation may account for the paralyzes of hysteria, it must be said that, as regards some other manifestations of the disease, the author has tended to squeeze his facts to fit his theory. It is stated, for example, that the hysterical fit of the military patient did not resemble that of the civilian in that violent convulsive movements were absent, the patient lying quite still with the reaction of immobility. Few who saw these fits will agree that this corresponds with what was observed.

In several directions Dr Rivers has, with his usual lucidity, helped to clarify the terminology used in medical psychology. He has drawn clear distinctions between Repression and Suppression, Dissociation and Suppression, which were very much required; and he has, with no small gain to clearness of thought, added two new words,

New Books

viz., "witting" and "unwitting." The act of repression may be partly within the patient's knowledge and partly not. When suppression has taken place it was certainly not by the patient's conscious will that the fact was accomplished. It is common to speak of it having been brought about unconsciously. Now the term "unconscious" should be kept for psychic events, which are kept below the censor; and as the conception is not that suppressed experience is drawn there by the unconscious, but that it is actively pushed down into it from above, a new word seems necessary; and to say that it is pushed into the unconscious unwittingly seems to be a great improvement in terminology.

The least successful part of the book is that dealing with clinical manifestations. The author, and he says so himself, is somewhat handicapped by want of experience in civilian cases. As an exposition of the doctrine of suppression, viewed from an angle different from that commonly employed, the book is of intense interest.

Some Conclusions on Cancer. By CHARLES CREIGHTON, M.D.
Pp. xiii + 365, with 114 illustrations in the text. London:
Williams and Norgate. 1920. Price 42s. net.

This book may be regarded as a critical estimate and discussion of certain aspects of the cancer problem by one who has given the subject a life-long study. Every problem is many-sided, but it would be difficult to find one with a wider range of interest than that of cancer, and one opens a book with such a title, bearing evidence of much independent thought and original observation, in the hope that some light will be thrown on the mystery which to-day still obscures its essential nature and cause.

Of the many aspects of the cancer question only one—that of its tissue-origin—is dealt with in any detail. The author's avowed intention is not controversial, yet at the outset he revives an almost forgotten controversy—that of the histogenesis of cancer. He calls in question the tacit assumption that such a fundamental question is settled, and sets out to controvert the Thiersch-Waldeyer theory that cancer arises from pre-existing epithelium.

The conclusion come to is that the key to the process is in the blood-vessels: the walls of the capillaries become changed into a syncytium, and these syncytial loops develop into solid alveolar masses of nucleated protoplasm. Neither in a normal uterine or intestinal mucosa, nor in the breast nor skin, is the pre-existing epithelium the dominant source; in all the cancer-cells are a transformation of capillary walls into "blood-built" nucleated protoplasm. When the author comes to explain how these additions on vascular lines acquire the type of epithelial growth he postulates the presence

New Books

of a ferment by which the blood is reduced to a trophic condition, and the cells of the capillary wall feed on this reduced blood. The next step in the pathological argument must necessarily be, how the tumour-cells acquire the type of the cell of the organ or tissue in which they arise. This also is referred to a ferment which determines the structural type just as it determined the reduction of the blood to a trophic state. No sufficient explanation is offered of the specificity of metastatic growths, nor of inoculated growths which may retain through numerous sub-transplantations the character of the original tumour.

In the closing chapter the author applies Aristotle's fourfold scheme to the causation of cancer. The *material* cause is the blood reduced by a ferment or lysin to an assimilable trophic state: the *formal* cause is the morphological idea followed out in the new growth: the *efficient* cause is the histogenetic means by which the structure is built up—vascular cells and tissues: and the *final* cause is the necessity that a blood-built substance should conform to a certain morphological type.

The whole book amply repays study, dealing as it does with a problem of intense human interest and criticising the most recent tendencies of experimental and other research. It is remarkable for its almost bewildering abundance of data and must prove a rich mine of reference, but probably few workers will be found to accept the author's conclusions, contrary as they are to the whole trend of modern conceptions of the diseases.

Orthopedic and Reconstruction Surgery—Industrial and Civilian. By FRED. H. ALBEE, M.D., F.A.C.S. Pp. 1138, with 810 illustrations. Philadelphia and London: W. B. Saunders Company. 1919. Price 50s. net.

The enlarged title has allowed the inclusion of many conditions not usually considered in works on Orthopedic Surgery. Most surgical affections of the extremities and of the spine are reviewed, including the operative treatment by bone-graft of recent fractures, mal-united and un-united fractures.

The author's well-known work on bone-grafting in the treatment of injuries, diseases, and deformities of bones and joints forms the outstanding feature of this book, giving it a value not easily over-estimated.

The chapter on the "Fundamental Principles underlying the Use of the Bone-graft in Surgery" is an instructive resumé of the theories and experimental findings of many workers on the rôle of the bone-graft whether osteogenetic or osteoconductive, on the rôle of the periosteum, and on the comparative values of different materials for bone-transplantation. The superiority of the bone-graft over metal

New Books

plates, nails, and screws, and of absorbable kangaroo tendon over silver wire, is maintained and demonstrated. The tabulation of nineteen indications for bone-grafting covers a varied range of surgical conditions, and yet "serves only as a suggestion of its wide field of usefulness."

There follows a chapter in which the author's "Electro-Operative Bone Outfit and Technic of Its Usage" are described and illustrated. The meagre armamentarium for bone and joint surgery in most hospitals is lamented. Albee aims at securing the accurate fit of the cabinet-maker, modelling his grafts into dowels, wedges, or inlays, and fashioning tongue and groove, dovetail, or mortised joints. For such work his special electro-motor instruments are indispensable, and in addition their use diminishes the operating time, reduces shock, and conserves the surgeon's energy.

In a chapter on "Roentgenology" the correct interpretation of X-ray photographs is discussed in relation to diseases of bones and joints. A short chapter is devoted to "Plaster of Paris Technic," but is confined to the plaster of Paris bandage. The concluding chapter deals with "Military and Industrial Reconstruction Surgery." Here is epitomised the early and later treatment of gunshot and other wounds of bones, joints, muscles, and nerves; along with the consideration of amputations and the provision of artificial limbs.

In all other respects the book deals with diseases and deformities of the spine and extremities along the usual lines of a treatise on orthopedic surgery. Each chapter has appended an extensive bibliography on the subject discussed. The illustrations are numerous, instructive, and excellently produced.

But the great value of the book is that it forms a record of Albee's great contribution to surgery, by his extensive application of the bone-graft to so many and varied surgical diseases and deformities, and as such it claims a notable place in recent surgical literature.

Human Parasitology. By DAMASO RIVAS, B.S. Biol., M.S., M.D., Ph.D. Pp. 715, with 440 illustrations. Philadelphia and London: W. B. Saunders Company. 1920. Price 35s. net.

This book deals with protozoa, helminthes, insects, and vegetable parasites in relation to man; and the author states that he has endeavoured to bring together the facts of parasitology in a form suitable to the needs of the student and physician, and to treat the subject so as not to omit any important fact or method. On turning to the account of the Amœbæ living in the human intestine, we read (p. 66) that *Entamœba histolytica* is 20 to 50 μ in length, and (p. 70) that it is 10 to 70 μ long (its diameter is really 20 to 40 μ), and that its protoplasm contains bacteria and detritus—a sign that the author has not

New Books

observed good material. He evidently believes, against all recent evidence, that gemmation occurs in *Entamoeba*, and he states erroneously that *E. coli* and *E. histolytica* have no chromidial masses. In a list of twenty-six authors of papers on these species no memoir is cited published later than 1915. There is no reference to *Endolimax nana*, discovered early in 1917, and since proved to be common in the human intestine, or to the I-cysts to which Wenyon drew attention in 1915. The account of the Amœbæ in the human intestine is defective in matter and long out of date.

Spirochætes are placed in the Flagellates, and among the characters given for the genus Spirochæta is the presence of an undulating membrane, e.g., in *S. recurrentis*—in which such a membrane does not exist. The author does not appear to know of Nicolle's important work on the transmission of this organism by the body-louse.

The author is quite in error in his notions of the relation between the redia and cercaria stages in the Trematode life-cycle, for he states that the redia develops a caudal appendage and assumes the form known as cercaria. In the account of the life-cycle of *Dibothriocephalus latus* there is no reference to the work of Janicki and Rosen (1917), who made the important discovery that Cyclops is the first intermediate host; and the part played by flea-larvæ in the life-cycle of *Dipylidium caninum* is apparently not known to the author. Fig. 182, labelled Ankylostoma, is obviously taken from a Necator.

In the part dealing with insects, Phlebotomus and sand-fly fever, Simulium and Oestrus are not even mentioned; there is no reference to trench fever and its transmission by lice, and to the mode of transmission of plague by fleas.

The number of misprints indicates a serious want of care; in the list of references on p. 59 there are seven mistakes in as many lines.

We recognise that the preparation of a text-book on human parasitology is a formidable undertaking for one author, and we fear it must be said that in this case the result is not very successful.

Hygiene. By W. WILSON JAMESON, M.A., M.D., M.R.C.P., D.P.H., and F. T. MARCHANT, M.R.San.I. Pp. 404. With 18 Illustrations. London: J. & A. Churchill. 1920. Price 18s. net.

Except for its price, which is surely excessive, even in these days, for an "Epitome" or "Synopsis" of only 404 pages including the index, this book should have proved useful for rapid reference. It is divided into eleven sections, and corresponds to the course given by the writers at University College. In the chapter on Statistics fuller reference to the problems of probability and to the theory of errors would have been desirable in view of the rapid development of mathematical methods in this branch of Hygiene. The chapters on

New Books

Meteorology and Physics and on Chemistry are very sketchy, but contain short summaries of certain parts of the subjects which are practically important in Hygiene. Apart from these criticisms the book is satisfactory both in its facts and in their presentation.

An Epitome of Hydrotherapy. By SIMON BARUCH. W. B. Saunders Company. Price 10s. net.

As a loyal follower of Pindar, Baruch echoes his famous words, "Water is best of all," and he really seems to believe it! In the little volume under review he gives a very lucid account of hydrotherapy, explaining both the technique and the principles involved, and though there is not much that is new in what he says, he makes his points uncommonly well. The chapter on the instalment of a hydriatic department is likely to prove exceptionally useful, for it is full of the results of his own ripe experience. In a few places there is a lack of precision in the use of physical terms—the most serious being the use of "temperature" when "heat" is meant.

Midwifery. By TEN TEACHERS. Second Edition. Edited by Comyns Berkeley, H. Russell Andrews, and J. S. Fairbairn. Pp. 772. Illustrated. London: Edward Arnold. 1920. Price 30s. net.

When the first edition of this book appeared there were not wanting those who pronounced it lacking in "character," if one can speak of "character" in a book. Perhaps this was to some extent the inevitable result of its composite authorship, and of their close collaboration. It would seem, however, judging from the rapid call for a second edition that the very absence of pronounced opinions has proved rather a recommendation.

The present edition has been enlarged by some forty pages, but there is an increase in actual bulk of about 20 per cent., an increase that is somewhat difficult to account for.

A welcome innovation is the chapter on Antenatal Hygiene, and we congratulate the authors on this new feature. In the department of antenatal care more than in any other the science of obstetrics has advanced during the last decade, and there is no doubt that along this road will be found the solution of many of the problems involved in the alarmingly high ante- and intra-partum and neonatal death rates in this country. It is fitting therefore that the importance of the subject should be emphasised by a special chapter devoted to it alone. The chapter is well written but far too little detailed to act as a guide to the student or practitioner who has not already had some practical acquaintance with the subject. The appended chart, however, will be

New Books

distinctly useful as a reminder of the chief points requiring attention during the examination.

A section has been added on normal and abnormal metabolism which gives added interest to the chapter on Toxæmias, and the brief addendum on Modern Biochemical Methods of Testing Renal Efficiency is well worth the three pages devoted to it, though necessarily insufficiently detailed to be of practical value. The chapter on the management and feeding of the new-born child has apparently been almost entirely rewritten, and much new matter has been added, following in the main the directions laid down by Dr Truby King. The directions for the care of the premature child are, in our opinion, insufficiently detailed; e.g., the exact temperature of the room should be given, the method of feeding should be described, and mention might be made of the increased liability of these infants to infections of all kinds, and hence of the greater necessity for guarding against them. Neither are we sure that the absence of the spirochæte pallidum from the organs and placenta of dead or premature children is reliable evidence of the absence of congenital syphilis, as appears to be assumed at p. 624. We should place equal or greater reliance on the *histological* examination of the organs and placenta.

The book can be cordially recommended to students and practitioners as a safe and up-to-date guide to the science and practice of midwifery.

The Difficulties and Emergencies of Obstetric Practice. By COMYNS BERKELEY and VICTOR BONNEY. Third Edition. Pp. xii + 809. With 309 Illustrations. London: J. & A. Churchill. 1921. Price 42s. net.

The issue of the third edition of this book within the space of seven years, most of them years particularly unfavourable for the sale of medical text-books dealing with obstetrics, speaks for itself concerning its usefulness to the obstetrician. The present edition has been thoroughly revised and much new matter added, especially in the chapter on the feeding of infants. We have always looked upon half the amount of veratrine suggested by the authors as the maximum compatible with safety. The book is beautifully bound and printed, the illustrations are excellent, and we cordially recommend it as an indispensable addition to the library of the obstetric surgeon and of the general practitioner.

BOOKS RECEIVED

EVE, Mrs ENID.	Manual for Health Visitors and Infant Welfare Workers (<i>John Bale, Sons & Danielsson, Ltd.</i>)	10s. 6d.
FULLER, Sir BAMPFYLDE.	The Science of Ourselves (<i>Henry Frowde and Hodder & Stoughton</i>)	16s.
GODLEE, Sir RICKMAN.	Six Papers by Lord Lister (<i>John Bale, Sons & Danielsson, Ltd.</i>)	10s.
HAY, JOHN.	Graphic Methods in Heart Disease. Second Edition (<i>Henry Frowde and Hodder & Stoughton</i>)	12s. 6d.
HENDERSON, JOHN.	Medicine for Nurses (<i>Edward Arnold</i>)	8s. 6d.
HORDER, Sir THOMAS.	Medical Notes (<i>Henry Frowde and Hodder & Stoughton</i>)	6s.
JANSEN, MURK.	Feebleness of Growth and Congenital Dwarfism (<i>Henry Frowde and Hodder & Stoughton</i>)	12s. 6d.
KERRISON, PHILIP D.	Diseases of the Ear. Second Edition (<i>J. B. Lippincott Company</i>)	35s.
KNOX, ALICE VANCE, and ROBERT KNOX.	General Practice and X-Rays (<i>A. & C. Black, Ltd.</i>)	15s.
RIVIERE, CLIVE.	The Early Diagnosis of Tubercle. Third Edition (<i>Henry Frowde and Hodder & Stoughton</i>)	15s.
ROBERTSON, W. G. AITCHISON.	Manual of Public Health. Fourth Edition (<i>A. & C. Black, Ltd.</i>)	10s. 6d.
ROBERTSON, W. G. AITCHISON.	Manual of Medical Jurisprudence and Toxicology. Fourth Edition (<i>A. & C. Black, Ltd.</i>)	12s. 6d.
RUSSELL, WILLIAM.	The Sphygmometer: Its Value in Practical Medicine (<i>Baillière, Tindall & Cox</i>)	7s. 6d.
SCOTT, T. BODLEY.	Why do we Die? (<i>T. Fisher Unwin</i>)	6s.
STITT, E. R.	Practical Bacteriology, Blood Work and Animal Parasitology. Sixth Edition (<i>H. K. Lewis & Co., Ltd.</i>)	20s.
WARWICK, F. J., and A. C. TUNSTALL.	"First Aid" to the Injured and Sick. Eleventh Edition (<i>John Wright & Sons, Ltd.</i>) Paper covers, 2s. 6d.; leather	5s.
WHITAKER, J. RYLAND.	Anatomy of the Brain and Spinal Cord. Fifth Edition (<i>E. & S. Livingstone</i>)	12s. 6d.
WHITFIELD, ARTHUR.	A Handbook of Skin Diseases and their Treatment. Second Edition (<i>Edward Arnold</i>)	18s.
WILSON, R. M.	The Care of Human Machinery (<i>Henry Frowde and Hodder & Stoughton</i>)	10s. 6d.

Edinburgh Medical Journal

April 1921

PRENATAL DEATH.

By ARTHUR ROBINSON.

(Continued from page 151.)

THE evidence so far produced and referred to shows that prenatal death is common and variable in several different groups of mammals, and as it occurs regularly in groups so widely separated, zoologically, as those mentioned, it is most probable that when further investigations are made it will be found to occur in all mammals, but in varying proportions in different groups.

Prenatal death, however, is not limited to mammals but is found also in birds, if death before hatching can be counted as prenatal.

Pearl's results¹⁹ point to a 20 per cent. prenatal mortality in his normal series inasmuch as he obtained 80 chicks from 100 eggs, and the experiments of Cole and Bachhuber⁴ indicate that prenatal death in fowls varies in amount with different matings.

It is clear, therefore, that prenatal death is a regular phenomenon in some groups of mammals and probably in all groups. It is equally clear that it is variable in amount in those groups in which it is present, in association with different matings. The variability is marked, and as it points to certain conclusions regarding the cause of prenatal mortality it must be considered in more detail. For this purpose the records of the Clydesdale and thoroughbred horses afford the most extensive data at present available.

The data given in Table IIA show that in Clydesdales the variations extend from 0 per cent. to 100 per cent.; 9 stallions mated with 33 mares giving the former, and 7 stallions mated with 31 mares the latter result, whilst practically all the intermediate stages are found in association with one or the other of the 28,241 matings. In thoroughbreds the variations are

Arthur Robinson

less extreme, the limits being 34·78 per cent. in the case of one stallion mated with 46 mares and 98·07 per cent. in the case of one stallion mated with 52 mares.

The greatest number of matings in any one year which resulted in a prenatal mortality rate of 0·00 per cent. was 7, and the greatest number of matings which gave a prenatal death rate of 100 per cent. was 14; but the first result does not indicate that the stallion concerned was hyperpotent, nor the second result that the stallion concerned was impotent, but merely that the one had the good fortune to meet with seven mares in succession with which he was fertile, and the other the misfortune to meet with eleven mares in succession with which he was infertile; for the records show that when stallions are mated with a considerable number of mares in any one year one or more of them is infertile with as many as fourteen or more mares, and further it is certain that a stallion which was fertile with eleven successive mares in one year was infertile with more than eleven out of a larger number in another year. In this respect the record of the Clydesdale stallion numbered 10/14 is instructive. It shows the following results in four successive years. First year 27 matings, prenatal death rate 44·50 per cent. Second year 29 matings, prenatal death rate 51·80 per cent. Third year 11 matings, prenatal death rate 0·00 per cent. Fourth year 28 matings, prenatal death rate 46·50 per cent. In the third year, therefore, he met with eleven successive mares with which he was fertile, whilst in the other years, in the groups of mares with which he was mated, there were 12, 15, and 13 respectively with which he was infertile; therefore had he had the misfortune to meet with only those particular mares in any given year he would in that year have been associated with a prenatal death rate of 100 per cent.

It appears, therefore, that from breeding experiments alone, unless they were carried out on a very extensive scale, it would not be possible to say that any stallion, or probably any other male mammal, was impotent, for the thoroughbred stallion numbered 15/12 was mated with 52 mares with the production of only 1 foal, and the Clydesdale stallion numbered 3/27 was mated with 103 mares but only 10 foals were produced, that is, the first was infertile with 51 mares and the second with 93 mares, whilst Clydesdale stallion numbered 9/4 was fertile with only 18 out of 114 mares with which he was mated. On

Prenatal Death

the whole the records show that whilst the extreme limits of the prenatal death rate are only met with when the number of matings is small, still very high death rates occur when the matings are numerous.

Relatively low as well as relatively high prenatal death rates are also found in association with numerous matings; for example, stallion numbered 6/23 was mated with 100 mares in two years with the comparatively low prenatal death rate of 16 per cent., and stallion numbered 13/20 was mated with 146 mares in the course of four years with a resulting prenatal death rate of 22.70 per cent.

The records contain no evidence which indicates the relative responsibility of the stallions as contrasted with that of the mares in association with the occurrence of high and low prenatal death rates, but the figures given in Table IV. indicate that certain stallions are regularly associated with a relatively high rate, others with a relatively low rate, and some with very variable rates in different years.

TABLE IV.

A <i>Clydesdale Stallions associated with a relatively high prenatal mortality rate.</i>			B. <i>Clydesdale Stallions associated with a relatively low prenatal mortality rate.</i>			C. <i>Clydesdale Stallions associated with a variable prenatal mortality rate.</i>		
Stallions.	No. of Mares.	P.N.M.R. per cent.	Stallions.	No. of Mares.	P.N.M.R. per cent.	Stallions.	No. of Mares.	P.N.M.R. per cent.
9/4	45	91.2	3/14	43	48.9	4/4	57	28.0
"	10	50.0	"	100	38.9	"	93	54.9
"	59	84.8	"	74	33.8	"	65	66.1
11/10	34	82.4	13/8	36	33.4	2/1	21	52.4
"	51	68.8	"	21	33.4	"	30	56.6
"	33	72.8	"	13	30.8	"	193	41.4
			"	14	28.6	"	68	34.8
14/9	50	84.0	11/11	34	26.5	"	49	22.4
"	78	65.5	"	61	41.0	"	71	28.2
"	57	61.5	"	41	34.2			
6/3	88	69.4	"	25	12.0			
"	31	64.6				9/5	38	42.2
"	24	50.0	12/19	75	32.0	"	89	28.7
			"	50	36.0	"	68	33.9
7/23	81	69.2	"	71	26.8	"	70	62.9
"	84	50.0	"	67	34.4	"	48	52.1
"	95	74.8						
			4/23	26	38.5			
			"	74	27.1			
			"	86	23.3			

Arthur Robinson

The records of the thoroughbreds give similar results, some stallions being regularly associated with a high, some with a low, and some with a variable prenatal mortality rate in different years, the difference between the highest and lowest rate, in a series of four years, being in the case of one stallion 38.9 per cent.

The data concerning the Clydesdales and thoroughbreds show not only that in those two groups of horses prenatal mortality of shed ova is regularly present and large in amount, but also that the amount is variable in different matings and in association with the same male in different years when probably he was mated with a different group of mares.

The ferret data give no information regarding the variation of the prenatal death rate associated with different males, they merely show that a large amount of prenatal death takes place and that it varies in association with different matings, and Hammond's figures relating to swine and rabbits indicate that similar conditions occur in those two groups of mammals.

The occurrence and variability in amount of prenatal death in several groups of mammals is certain, its causation has yet to be considered; but although the explanation of the occurrence lies in great part in its variability, it is advisable before discussing the cause to inquire into where, when, and how the death takes place.

The Clydesdale and thoroughbred data give no help in this part of the inquiry, for none of the mares were killed, and after the completion of what appeared to be satisfactory service there was apparently no examination of the mares until the later months of gestation; further, there are no records of abortion.

Fortunately the ferrets provide answers to all three questions, and their evidence is confirmed, with regard to certain points, by Hammond's small series of swine and rabbits, by Corner's swine,⁶ by Huber's rats,¹² and by Hill's marsupials, and in addition by some observations made by Meyer on intra-uterine absorption of ova,¹⁷ which show that the cause of prenatal death cannot in some cases be attributed to uterine disease.

In ferrets, when the ovarian follicles burst, the ova are usually carried by the rush of liquor folliculi into the middle third of the oviduct, where they meet the spermatozoa and in normal circumstances become fertilised.

The zygotes which are formed remain for five days in the oviduct, gradually passing towards its caudal end. At first they

Prenatal Death

lie relatively close together, but generally separated by small intervals; as they pass caudally the intervals between them gradually become greater, and during the sixth day after extrusion they enter the uterine cornu in regular sequence.

During the next seven days those which entered the uterine cornua first pass caudally along the tube, and from the latter part of the thirteenth day to the end of the fourteenth day the chorionic part of the zygote begins to become attached to the decidua, the positions of fixation of the different ova being separated from one another by fairly regular intervals.

It follows, therefore, if the ova or zygotes in the oviduct, during the first five days after insemination, do not correspond in number with but are fewer in number than the corpora lutea in the ovaries, that either some of the ova have escaped into the peritoneal cavity, where they would disintegrate and become absorbed, or that they are retained in the peri-ovarial capsule, or that they have entirely broken down and disappeared, and the normal or abnormal appearance of those which are found in the oviduct is easily ascertained.

There is no reason to think that an extruded ovum would break down and entirely disappear in the course of five days either in the peri-ovarial capsule or in the oviduct, for degenerate ova which have failed to be fertilised, and degenerate young zygotes in the earliest stages of segmentation, are found in the uterine cornua several days later (Fig. 15, Plate III.). It must be assumed, therefore, that such missing ova have escaped into the peritoneal cavity in spite of the small and closely guarded orifice of the peri-ovarial capsule. The assumption is justifiable, not only because other causes of loss do not seem to be present but also because it is certain that ova can escape through the orifice of the peri-ovarial capsule, for as already shown, on the screen, I have been fortunate enough to secure one so escaping.

Occasionally ova fail to escape from the peri-ovarial capsule either into the peritoneal cavity or into the oviduct. I have three such specimens, and in two of the three the retained ovum is in a state of degeneration.

The number of ova which break down rapidly or escape into the peritoneum is considerable, though relatively small, for in ten selected ferrets killed during the first five days after the extrusion of the ova there were 94 corpora lutea in the ovaries and the ova and zygotes in the oviducts numbered only 79, therefore 15 out of the 94 extruded ova had

Arthur Robinson

disappeared entirely, and as no trace of them was discoverable, it is practically certain that they escaped into the peritoneal cavity.

Some of the extruded ova which pass into the oviduct in ferrets do not become fertilised, either because, although apparently normal, they are structurally imperfect, or because they fail to meet the necessary spermatozoon, in spite of the fact that spermatozoa are present, and that other ova from the same ovary are fertilised (Fig. 13a, Plate III.). Such ova may remain surrounded by a degenerating corona radiata even after they have passed from the oviduct into the uterine cornu, as you have seen from specimens already shown, a condition which never occurs in association with normally developing zygote.

A few ova are penetrated by several spermatozoa and develop multiple pronuclei; such ova probably undergo degeneration at later periods, as in other animals under similar conditions, but naturally from the nature of the observations there is no proof that the suggested degeneration does take place in the case of ferrets.

Some ova die during the morula stage of development. In such cases there are no indications of anything abnormal in the oviducts or uterine cornua, and other zygotes of the same group are quite normal. It is not possible to ascribe the death of such zygotes to abnormal conditions of the mother, for the degenerate zygotes had not reached the period at which nutriment is absorbed from the maternal tissues, and nutriment, if any, derived from the surrounding fluid was as fully available to the degenerate as to the normal zygotes.

I have secured only one definitely abnormal specimen between the sixth and the thirteenth days of development, but I have several groups of zygotes between the sixth and the fourteenth day in which one or two are so much smaller than the others that their normality is doubtful although no obvious signs of degeneration were discoverable in them.

After the fourteenth day when the zygotes become attached to the decidua many cases occur in which one or more of the zygotes in a uterine cornu are obviously degenerate. In such cases the gestation chamber containing the degenerate zygotes is decidedly smaller than those adjacent to it which contain normal zygotes, and when sections of the smaller chamber are made it is always found that the zygote it contains is more or less degenerate or abnormal (Figs. 9a and 9b, Plate I.; Figs.

Prenatal Death

10a to 12b, Plate II.; Figs. 16a, 16b, 17, 18a, and 18b, Plate III.)

In such cases there are no signs of inflammation. No micro-organisms are discoverable in the sections, and there are no indications that the blood supply of the portion of the cornu which contains the degenerate zygote is in any way different from the blood supply of adjacent gestation chambers which contain normal zygotes.

In ferrets, therefore, extruded ova die in the peritoneal cavity into which they have escaped; in the peri-ovarial sac from which they have failed to escape into the oviduct; in the oviducts; and in the uterine cornua.

They die when they are still ova, either because they are lost in the peritoneal cavity or because they fail to unite with spermatozoa although spermatozoa are present. They die after they have become zygotes, both in the morula stage (Fig. 15, Plate III.) and in the blastula stage (Fig. 10b, Plate II.) before they have become attached to the decidua. They die also after the blastula has become attached to the decidua and after the zygote has differentiated into embryo and appendages; thus the questions of when and where are answered.*

It is more difficult to decide how the zygotes die, but it is always apparently by alterations of their structure, which ends in disintegration.

Whilst the ova are still unfertilised and in the zygote stage, up to the end of the morula period, death is indicated in the ferret by the osmic blackening lipid material, which is always present in large amount, losing its regular arrangement of spheres of varying but moderate size and running into large irregular masses, and by vacuolation of the nuclear and protoplasmic substance, by nuclear and cellular lysis, and by irregular segmentation.

In the later stages malformations of the germinal area, abnormal adhesion of the zygote to the decidua or absence of the germinal area (Fig. 11b, Plate II.), and nuclear and cellular lysis end in ultimate general disintegration.

The death is not due to inflammation or to micro-organismal attack, but apparently simply to an incapability to live and develop properly under conditions which are quite favourable to immediately adjacent zygotes.

* See Figs. on Plates I., II., and III., which are a few selected from the specimens shown during the lecture.

Arthur Robinson

Similar conditions have been found in various other groups of mammals.

In *Dasyurus*, amongst the marsupials Hill,¹¹ as already noted, states that he met with a group of 35 ova of which 12 were abnormal, and the cleavage abnormalities which he mentions in other cases would most probably have resulted in death at a later period of gestation.

Stockard²² notes that many of the zygotes which must have been present in the gestation chambers which he was able to palpate in his guinea-pigs in the earlier periods of pregnancy failed to produce living young.

Corner⁶ has seen degenerate zygotes in swine in the period before the attachment of the decidua had commenced.

Hammond¹⁰ found that 15 out of 107 embryos in the uteri of seven sows were atrophic, and his figure of one uterus shows either that the atrophy had commenced at different periods in different embryos, or that it had proceeded more rapidly in the case of some embryos than in others.

Hammond also found that in a series of 38 rabbits, 82 of the 307 zygotes were atrophic, and he is satisfied that the atrophy both in pigs and rabbits was not due to the action of micro-organisms. He notes that in addition to the atrophic zygotes other ova had been shed of which he could find no trace in the uteri, and he suggests that such ova must have wandered into the body cavity; further abnormal morulae and gastrulae have been described in rats by Huber,¹² and Meyer¹⁷ found degenerate guinea-pig embryos whose death could but be attributed to uterine causes.

It is obvious from the records quoted not only that prenatal death occurs in many groups of mammals, but also that it occurs in apparently the same way in all the groups in which it has been noted, in different parts of the oviducts and uterine cornua, and at all the different periods of gestation.

In all cases the death is preceded by obvious degeneration or abnormal development, and there is no indication that it is due to bacterial action, whilst the possibility of poisons in the maternal blood or secretions is eliminated by the fact that the majority of the zygotes in multiple pregnancies develop normally, and only a minority, as a rule, die prematurely.

The positions and the time of prenatal death are not difficult to discover, but its cause is more elusive.

The causes which naturally suggest themselves are: the con-

Prenatal Death

dition of health of the parents ; the environment of the parents ; the food of the parents ; the age of the parents ; excessive use of the male ; the environment of the gametes and zygotes ; the nutrition of the gametes and zygotes ; the constitution of the gametes ; the constitution of the zygotes.

In the case of the horses the stallions were certified to be healthy, and there is no reason to suspect the health of the mares.

The ferrets, both male and female, were all healthy animals.

The environment of the stallions and mares was that which they and their ancestors for many generations have been accustomed to, and the same can be said with regard to the ferrets, with the exception of those which were fed and mated in my laboratory.

There is no evidence concerning the condition of most of the animals used by other observers, but presumably they were healthy and were kept in normal environment, whilst Stockard's control guinea-pigs were certainly healthy and they were kept in healthy surroundings.

As the general bodily condition of the horses and ferrets was good, it certainly could have no detrimental effect on their gametes or zygotes ; and as the ferrets dealt with in the laboratory gave results similar to those given by the animals provided by the breeders, under whose control the environment was that to which the animals and their ancestors were accustomed, there is no reason to assume that the environment of the parents caused either the prenatal mortality or its variations, unless it is assumed that the environment in which the animals in question now live is not that to which their far-away ancestors were accustomed, and that if the original conditions were returned to the prenatal mortality might perhaps disappear. Such a suggestion, however, is negatived by the fact that atrophic and dead embryos have been found in the uteri of wild animals such as rabbits (Hammond¹⁰), moles, and hamsters (Strahl and Henneberg,²³ 1902).

The question of food would scarcely have needed mention had it not been that the records of the Clydesdales extend from 1913 to 1918 inclusive, and those of the thoroughbreds from 1913 to 1917 inclusive, that is over one pre-war and several war years, whilst in addition the prenatal mortality rate of the thoroughbreds was less in 1913 than in any other year.

Arthur Robinson

The yearly results of the thoroughbreds are shown in Table V.

TABLE V.—*Thoroughbreds.*

Year.	No. of Stallions.	No. of Mares.	P.N.M.R. per cent.
1913	12	659	52.04
1914	14	769	58.77
1915	14	864	57.75
1916	15	748	62.16
1917	12	600	62.83

The difference between the results in 1913 and those in the succeeding years made it necessary to institute inquiries into the matter of food, and Mr James Wood informed me that there was no reason to think that the food in any of the war years differed from that of the pre-war period, except with regard to the amount of bran. It is improbable that a difference in the amount of that substance could have any appreciable effect on the prenatal mortality rate, inasmuch as it did not affect the health of the parents, or presumably alter the blood contents of the mother to any appreciable extent. Moreover, the yearly records of the Clydesdales, shown in Table VI., demonstrate that in their case the prenatal mortality rate was less in 1916, 1917, and 1918, than it was in 1913 and the two succeeding years.

TABLE VI.—*Clydesdales.*

Year.	No. of Stallions.	No. of Mares.	P.N.M.R. per cent.
1913	56	1903	48.34
1914	87	3029	50.54
1915	137	6988	49.39
1916	154	5327	46.56
1917	144	5332	46.02
1918	130	5662	46.23

It appears, therefore, that in horses the variations of the prenatal death rate are not dependent on the food supply of the parents, and the same may be said of the ferrets, for they were fed on the food to which they were accustomed. The other mammals afford no evidence upon the point.

As regards the age of the parents, it is stated that the fertility of mammals varies with their age, and according to Matthews Duncan⁷ "the initial fecundity of women gradually

Prenatal Death

waxes to a climax and then gradually wanes," and Marshall¹⁴ states that "there can be no doubt that animals, as a general rule, tend to follow a similar law," whilst Wallace²⁶ says that sows ought to rear six to eight young in their first litter and ten to twelve in each succeeding litter. Minot found that in guinea-pigs the size of the litters increased with the age of the parents, during the first sixteen months of their lives, and Hammond (1914), quoting from the results obtained by Mr P. G. Bailey, states that in rabbits the litters increase, at all events from the first to the third, but there is no evidence to show whether the results obtained were due to greater production of mature ova during the period of increase or to diminution of the prenatal death rate. Hammond appears to assume that the result is due to increases of ovum production, for he asserts that it appears that fertility can be modified to a certain extent by improving the nutrition of the ovary, and in support of his contention he quotes the results obtained by Marshall,^{14 15 16} in the case of ewes. Marshall found that "flushing" caused increased fertility, "probably due to the maturation of more follicles." The question raised is interesting and discussable, but in the meantime it is of no direct importance for the purpose in hand, which is not to show how ovum production is affected by age or special feeding of the mother, but to discover if possible the cause of prenatal death in the case of ova known to have been extruded. There is, however, an age factor, the age of the male, which presumably might have bearing upon the prenatal death rate, and with regard to this point the records of the Clydesdales fortunately afford evidence, for the ages of all the Clydesdale stallions are known; they vary from three to nineteen years, and the results of their matings at different periods of age are shown in Table VII.

It is obvious from the table that between the ages of four and eighteen years, in the case of Clydesdales, the age of the stallion is not associated with any essential difference in the prenatal mortality rate, and when the disproportion in numbers of the stallions of different ages is taken into account it does not appear that the age of the stallion has any appreciable effect upon the variations of prenatal mortality, except perhaps there is less variation in different matings when older stallions are used than when younger stallions are employed. This result is in accord with the general knowledge that there is no definite ending of the reproductive period in male animals.

Arthur Robinson

TABLE VII.

Ages of Stallions in years.	No. of Stallions.	No. of Mares with which they were mated.	P.N.M.R. per cent.
3	207	6546	52.1
4	150	5999	48.0
5	105	4512	46.6
6	76	3212	48.3
7	55	2026	45.0
8	42	1795	43.7
9	28	1069	50.5
10	20	1021	46.2
11	9	531	46.2
12	7	459	39.0
13	6	315	45.4
14	4	84	41.7
15	6	337	45.2
16	4	158	46.9
17	3	41	48.8
18	3	98	49.0
19	1	38	63.2

It has been suggested that excessive use of the male is a possible cause of sterility, fertilisable ova perishing because of the exhaustion of the male. The material at my command does not enable me to say whether or not there is any basis for the suggestion, but the records of the Clydesdale stallions show that the number of matings in a season must be very large before any such result follows. In Table VIII. the lowest and highest number of matings of selected individual stallions in different years are given, together with the accompanying percentage of prenatal death rates.

TABLE VIII.

Stallions.	Lowest Number of Matings.	P.N.M.R. per cent.	Highest Number of Matings.	P.N.M.R. per cent.
1/3	23	34.8	97	22.7
2/1	21	52.4	103	41.8
5/11	63	60.4	106	51.0
3/15	31	51.7	131	47.4
3/19	24	50.0	103	33.1

The stallions noted in the above table are chosen because they show the greatest differences between the lowest and highest number of matings in different seasons, and the results, so far as they go, seem to indicate that an increase in the

Prenatal Death

number of matings up to 131 in one season tends to reduce the amount of prenatal mortality associated with a given stallion.

A somewhat similar though less definite indication is obtained when the matings are grouped in increasing numbers as in Table IX.

TABLE IX.

No. of Matings in one Season.	No. of Mares.	P.N.M.R. per cent.	No. of Matings in one Season.	No. of Mares.	P.N.M.R. per cent.
I to 10	718	45.1	71 to 80	1794	47.0
11 " 20	1828	48.0	81 " 90	3038	50.0
21 " 30	2338	46.3	91 " 100	1708	47.0
31 " 40	3252	49.1	101 " 110	1260	46.0
41 " 50	3429	48.0	111 " 120	346	37.0
51 " 60	3617	48.0	121 " 130	374	40.0
61 " 70	4137	52.0	131 " 140	402	41.0

Although Tables VIII. and IX. do not show that exhaustion of the male is not a possible cause of increase of the prenatal death rate, they do show that the use of the male before such exhaustion occurs must be very excessive, and that exhaustion of the male cannot be considered as a potent factor either in the production of prenatal death or in the production of its variations.

With regard to the environment of the gametes as a possible factor in the production of prenatal death, their normal surroundings are the tissues of the genital glands and the walls of the genital passages of the parents, and in healthy animals both groups of organs would presumably be healthy.

It has already been stated that the Clydesdale and thoroughbred stallions were certified healthy, and in the case of the male gametes, therefore, there is no reason to doubt that the gametal environment was normal. As regards the mares there is no evidence, but as none of them are noted as unhealthy it may be assumed that they were healthy and that the surroundings of their ova were normal.

In the case of the ferrets there is no doubt about the normal environment of the gametes, for post-mortem examination both macroscopical and microscopical demonstrated the healthy condition of the ovaries and female genital passages, whilst the males which were used in the laboratory were young and vigorous, and histological examination of their testicles

Arthur Robinson

proved that those glands were perfectly developed and in full functional activity.

The males used by the breeders were, of course, not killed, but there is no reason to believe that they were not healthy, for the results obtained by their use as before stated were the same as those associated with the males used in the laboratory.

With regard to the nutrition of the gametes and the nutrition of the zygotes, at all events up to the time when the latter become attached to the uterine decidua, we possess very little knowledge, but as we are dealing at present, in the case of the horses, only with parents which were healthy it may be assumed that the nutrition of the gametes and young zygotes was normal; moreover, it is quite certain in the case of the ferrets that the fluid contents of the oviducts and uterine cornua were normal, and that the contents of the efferent ducts of the males used in the laboratory were also quite normal.

It is also certain, in the case of the ferrets, that the fluid contents of the oviducts and uterine cornua were not the cause of the death of the extruded ova and the young gametes which were found in a state of degeneration, for dead and normally developing ova and young zygotes were found in the same passages and therefore in the same fluid surroundings.

There is no reason to believe, therefore, that under ordinary circumstances the prenatal death rate is influenced by the fluid contents of the oviducts and uterine cornua, nor is there any reason to suppose that the death of the zygotes which have become attached to the uterine decidua is caused by any interference with their nutrition due to the condition of the decidua, for in ferrets a dead zygote or degenerate zygote is frequently situated between two normal zygotes, and there is no evidence that the blood supply of the walls of the gestation chamber of the dead zygote differs in any way from that of the blood supply of the walls of the adjacent gestation chambers.

As prenatal death occurs regularly in healthy animals placed in normal surroundings, and it is not, apparently, influenced by the food of the parents, the age of the parents within certain limits, or by the very frequent use of the male, and as it is practically certain that in healthy animals the nutrition and environment of the gametes and zygotes is normal, the inevitable conclusion is that the cause of the death which overtakes more than 50 per cent. of the extruded ova of thoroughbreds, 48 per

Prenatal Death

cent. of the extruded ova of Clydesdales, and probably not less than 35 per cent. of the extruded ova of ferrets, is due to the constitution of the gametes and zygotes.

In Clydesdales and thoroughbreds there is no reason to suppose that the extruded ova and spermatozoa were not normal. In ferrets I have never seen in a mature and normal ovarian follicle an ovum which did not appear to be normal in constitution, and the spermatozoa which were found in the oviducts were in all cases normal in appearance.

In ferrets some, but relatively few, ova escape into the peritoneal cavity and there disappear; they therefore add a little to the prenatal death rate, but not more than 5 per cent. at the most, though in other mammals, not provided with periovarial capsules, the loss by escape into the peritoneal cavity may be relatively greater than in ferrets. It is clear also in the case of ferrets that some of the extruded ova fail to unite with spermatozoa although spermatozoa are present, that other ova which show multiple pronuclei are probably penetrated by several spermatozoa and so form polyspermic zygotes which presumably die, but the ova which fail to unite with spermatozoa and those which form polyspermic zygotes are relatively very few.

The majority of the extruded ova become zygotes, and of those the majority which die in the prenatal period die after they have become attached to the decidua, that is from the fourteenth to the forty-second day of gestation. The death rate of ferrets' ova during the first thirteen days after insemination appears to be about 20 per cent., whilst the rate during the remaining period of twenty-nine days is about 30 per cent., and the greater part of the prenatal death rate is due to the death of zygotes.

The ferrets show that some ova, though they are apparently normal, are nevertheless incapable of uniting with some spermatozoa, and that other ova, although they are capable of uniting with spermatozoa which are present, form, by the union, zygotes which are incapable of living to the end of the prenatal period under circumstances which appear to be quite normal and in which other ova and spermatozoa form zygotes from which viable young are evolved.

The records of the Clydesdale and the thoroughbreds, on the other hand, show that the spermatozoa of certain stallions are incapable of uniting with the ova of some mares to produce

Arthur Robinson

viable young, whilst they produce normal zygotes which give rise to normal viable young with the ova of other mares.

The conclusion to which the evidence available points is that the alteration of the constitution of the ova and spermatozoa which is so favourable for the production of the individual variations that are such a constant feature of animal life, and which presumably takes place during the maturation of the gametes, is also the cause of the formation of many gametes whose capability for union with gametes of the opposite sex is limited, and of others whose union with gametes of the opposite sex results only in the formation of abnormal zygotes, that is zygotes incapable of evolving a new individual devoid of visible abnormality and capable of living through the normal period of life of an individual of its species, under the ordinary circumstances and in the absence of accident, micro-organismal attack, and artificial acid. It is therefore a structural peculiarity of the gametes which is the cause of sexual incompatibility.

Most probably some of the gametes of each sex are modified in the way suggested during the maturing divisions, and those of some individuals more than others. The experiments of Cole and Davies,⁴ by double mating with rabbits, point to differences of the spermatozoa as a more potent cause than differences of ova. They mated an albino male and a pigmented male, sometimes the one first, sometimes the other, with the same females, and as a result of the twenty-three double matings 190 young were born of which only 24 were albinos; obviously, therefore, more spermatozoa of the pigmented male than of the albino were capable of forming fertile unions with the ova of the females used.

The data provided by horses and ferrets, supplemented by those which can be gleaned from notes made with regard to other mammals, point therefore to the conclusion that a large amount of the prenatal death which occurs in mammals is normal, that it is not dependent upon disease of the parents, detrimental environment, insufficient nutrition, or disease of the gametes, but is, in a sense, a side issue of the process which gives rise to the variations which appear so universally in all mammals and probably in all living beings.

It has already been noted that the prenatal death rate of the extruded ova of Clydesdales is 48 per cent., that of thoroughbred ova 58.68 per cent. In the case of ferrets the rate appears to be about 35 per cent., and it is apparently about

Prenatal Death

the same in swine, but in the case of the latter animals the data are not sufficient to justify a definite conclusion. In rabbits, so far as data are obtainable, the rate appears to be somewhat over 37 per cent. There is then no doubt that the rate of prenatal death is high in several groups of mammals.

As the prenatal death rate is undoubtedly high in several groups of widely different mammals, there is every reason to believe that it will eventually be found to be not less high in other groups, including man.

If prenatal death is constant and normal, the obvious corollary is that in some animals abortion also is normal.

The abortion of ova which have failed to be fertilised, and of young zygotes which have died before becoming attached to the decidua, will, in many cases, be unnoticed, for it will occur without causing any definite inconvenience to the female, whilst thereafter the mucous membrane of the uterus will return quickly to the condition favourable for a new conception; but if the death of the zygote occurs after the attachment to the decidua has commenced, and still more if after the attachment is completed, the conditions are more complicated and are likely to result in more definite inconvenience.

The continuance of gestation after the attachment of the zygote to the decidua depends not only upon the normal development of the zygote but also upon the normal development of the decidua, the latter being controlled by the growth and development of the corpora lutea.

If any zygote dies after the fixation period, the gestation, so far as it is concerned, is brought to a termination, and it is necessary for the maintenance of the normal birth rate that it—the dead zygote—shall be removed as soon as possible.

The removal is provided for differently in different groups of mammals. In those which produce multiple young at birth the dead zygotes, in all but the latest stages, are absorbed, for any other process would result in the death of some or all of the other zygotes, and the birth rate of the group would be considerably reduced in view of the fact that, in animals which have multiple young, the death of one or more of the zygotes is of frequent occurrence, as is shown by the results noted in ferrets, swine, and rabbits.

As soon as the zygote dies, its influence on the decidua ceases; that membrane no longer furnishes nutriment to the zygote, and it is no longer preyed upon by the zygote; on the contrary, it

Arthur Robinson

absorbs the degenerated and disintegrated zygote, and then returns to the condition of the ordinary mucosa of the intervals between the gestation chambers.

Absorption, however, takes a very considerable time, and it would obviously be detrimental to the birth rate of animals which have a long gestation period, and which only produce one young at each birth period, as in the case of the human subject. In such cases, therefore, death of the zygote is followed, as a rule, very quickly by abortion, and thereafter, in a comparatively short time, the uterine mucosa regains a condition favourable for a new gestation.

As soon as the zygote is dead, changes occur in the decidua such as those which Mall found in human uteri. (Compare Figs. 9a and 9b, Plate I., and Figs. 12a and 12b, Plate II.) Such changes are commonly attributed to degeneration or disease of the decidua, and are looked upon as the cause of the death of the zygote. There is no doubt that disease of the decidua may cause death of the zygote, but in all those cases of abortion which occur in association with healthy animals the cause is the death of the abnormal zygote, and the changes in the decidua are not properly described when they are termed degenerative; they might more correctly be termed regressive, for they are adapted to bring about, as soon as possible, a normal proœstral condition of the uterine mucosa.

In view of the very general belief expressed by obstetricians that abortion is abnormal and is very frequently due to disease, and the popular belief that the human birth rate ought to be very much higher than it is, behind which lies the further belief that every ovum under favourable conditions should produce a living child, the conclusions derived from the investigation of healthy animals under normal conditions may be looked upon as possessing some practical importance—at all events they must be taken into consideration when any estimate is being made of the possible birth rate of any given group of animals.

The four chief conclusions to which the evidence produced points are:—

- (1) That some sterility is normal and unavoidable.
- (2) That a considerable amount of prenatal death is normal or usual, and, under ordinary circumstances, cannot be avoided.
- (3) That a considerable number of abortions are not only normal but necessary, for they are adapted to prevent diminution of the birth rate.

Prenatal Death

(4) That the condition of the uterine mucosa associated with normal abortions is not degenerative or diseased, but normal, and that any treatment of it is not only unnecessary but will probably also be detrimental.

If we assume that every 100 married human females should produce each year 100 children, then I find from data very kindly given to me by Dr Newsholme and the Registrar-General for Scotland that the prenatal death rate in association with married women between the ages of 15 and 45 years in England for the period 1876-1880 was 70.3 per cent. It had increased by 1910 up to 78.71 per cent. In Scotland in 1908 it was 74.96 per cent., and in 1917 it was 81.89 per cent.

Unfortunately we have no knowledge and no means of ascertaining what the normal human prenatal death rate is, but if we assume it to be somewhere about 40 per cent., which is probably below the actual amount, then in England, in 1910, 38.71 per cent. of the whole was not normal, and in Scotland, in 1917, 41.89 per cent. was not normal; therefore of the total prenatal mortality rate of extruded human ova placed in favourable circumstances for fertilisation, about half, presuming the normal rate to be 40 per cent., is due to causes which are in a sense unavoidable, and no treatment of the mothers either general or local will do any good, whilst it may do much harm.

The present communication is not concerned with the remaining and avoidable part of the prenatal mortality, but it must be pointed out that the assumption that the prenatal mortality rate of human beings is 40 per cent. is only based on indications given by horses, ferrets, swine, and rabbits. It may be lower or higher, but is more probably higher than lower, for human beings are living in much more artificial conditions than are the other animals mentioned, and they are more exposed, under present-day conditions, to agencies which have a detrimental effect on the gametes and zygotes.

It is well known that high velocity rays have a detrimental effect on gametes.

Alcohol given to guinea-pigs and fowls by inhalation is injurious to the gametes, even to the third and fourth generation of the descendants of those treated; it is therefore quite possible that, taken in other ways, it is also injurious (Stockard,²² Cole and Davies⁵).

Lead administered to the male reduces the birth rate of both rabbits and fowls (Cole and Bachhuber⁴).

Arthur Robinson

So far experiments of importance have only been made with alcohol, lead, and high velocity rays, and it is quite possible that many substances used as foods, drinks, and condiments may prove harmful to gametes and zygotes when taken in excess. It is not improbable, therefore, that the normal human prenatal death rate associated with the conditions under which we are now living, is higher than 40 per cent. That, however, at present, is a mere speculation.

SUMMARY.

(1) A considerable amount of prenatal death is normal in mammals.

(2) It is due partly to the inability of the gametes of certain individuals to unite with one another and partly to the production of abnormal zygotes by the union of certain gametes.

(3) The inability to unite, and the production of abnormal zygotes when union occurs, are not dependent on disease or abnormal environment of the parents.

(4) When prenatal death occurs, as it does in many cases, after the zygote has become attached to the decidua the death must be followed by the absorption or the abortion of the zygote.

(5) Abortions which follow normal prenatal death are themselves normal, and the changes found in the uterine mucosa in such cases are regressive and useful, and not inflammatory or degenerative.

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EXPLANATION OF PLATES I-III.

PLATE I.

- FIG. 1. Uterine cornu of a ferret in the 13th day of gestation, showing normal and abnormal gestation chambers. The chamber most to the front on the left side of the fig. contained a degenerate zygote. $\frac{2}{3}$ natural size.
- FIGS. 2a and 2b. Opposite views of a uterine cornu of a ferret in the 14th day of gestation. In 2a two small gestation chambers which contained degenerate zygotes are seen. In 2b a normal chamber is shown; it lies midway between the two abnormal chambers. $\frac{2}{3}$ natural size.
- FIG. 3. Part of a uterine cornu of a ferret in the 15th day of gestation, showing a normal and an abnormal gestation chamber. $\frac{2}{3}$ natural size.
- FIG. 4. Portions of a uterine cornu of a ferret in the 16th day of gestation, showing four normal and one abnormal gestation chamber. $\frac{2}{3}$ natural size. See also Figs. 9a and 9b.
- FIG. 5. Uterine cornu of a ferret in the 22nd day of gestation, showing four normal and one abnormal gestation chambers. $\frac{2}{3}$ natural size. See also Figs. 12a and 12b.
- FIG. 6. Part of a uterine cornu of a ferret in the 23rd day of gestation, showing one normal and two abnormal gestation chambers. $\frac{2}{3}$ natural size.
- FIG. 7. Part of a uterine cornu of a ferret in the 28th day of gestation, showing two gestation chambers which contained normal embryos, and one chamber which contained an abnormal embryo. $\frac{2}{3}$ natural size.
- FIG. 8. Part of a uterine cornu of a ferret in the 31st day of gestation, showing two gestation chambers which contained normal embryos and one chamber which contained an abnormal embryo. $\frac{2}{3}$ natural size.
- FIG. 9a. Section through the ventral part of one of the normal gestation chambers seen in Fig. 4. In the lower or ventral part of the fig. a transverse section of

Arthur Robinson

the embryo is seen. Below and on each side of the embryo is part of the placenta, showing the normal arrangement. $\times 4$. Hæmatoxylin eosin.

FIG. 9b. Section through the abnormal gestation chamber seen in Fig. 4. A part of the remnant of the zygote is seen in the form of two triangular black dots with connecting lines. Below the remains of the zygote is the regressive placental area. $\times 4$. Hæmatoxylin eosin.

PLATE II.

FIG. 10a. Section through a gestation chamber of a ferret in the 15th day of gestation. The chamber contains a degenerate zygote. $\times 4$. Osmic preparation, unstained.

FIG. 10b. Part of the gestation chamber shown in Fig. 10a. $\times 20$. The degenerate zygote is a small vesicle with no definite embryonic area. Compare with Fig. 10d.

FIG. 10c. Section through part of a normal gestation chamber from the same uterine cornu as the preparation shown in Fig. 10a. $\times 4$. Osmic preparation, unstained.

FIG. 10d. The ventral part of the gestation chamber seen in Fig. 10c. Showing a transverse section of the normal embryonic area and the normal structure of the placenta.

FIG. 11a. Section through an abnormal gestation chamber from a uterine cornu of a ferret in the 15th day of gestation, showing the ventral part of the zygote fused with the ventral part of the wall of the placental area of the gestation chamber. $\times 4$. Osmic preparation, unstained. Compare the size of the ventral part of the placental area with that of the corresponding region of the normal gestation chamber shown in Fig. 11c.

FIG. 11b. The median part of the ventral wall of the gestation chamber shown in Fig. 11a. $\times 20$. The embryonic area is absent, and the placental part of the chorion is fused with the ventral wall of the gestation chamber instead of with the sides only, which is the normal condition at the 15th day.

FIG. 11c. Part of a normal gestation chamber, from the same uterine cornu as the specimen seen in Fig. 11a. $\times 4$. Osmic preparation, unstained.

FIG. 11d. The ventral part of the gestation chamber shown in Fig. 11c. $\times 20$. The embryonic area of the zygote is distinct, and at each side of the placental part of the chorion is fused with the placental area of the uterine mucosa. In the specimen shown the embryonic mesoderm has separated from the placental part of the chorionic ectoderm on the left side of the preparation, and at each side of the embryonic area the amniotic ectoderm has broken off from the chorionic ectoderm, the rupture being due to shrinkage during the preparation of the specimen.

FIG. 12a. Normal placenta, from part of one of the normal gestation chambers shown in Fig. 5. 22nd day of gestation. $\times 20$. Hæmatoxylin eosin.

FIG. 12b. Part of the regressive placenta from the abnormal gestation chamber shown in Fig. 5. $\times 20$. Hæmatoxylin eosin.

PLATE III.

FIG. 13a. Section of an abnormal unfertilised ovum, from the uterine cornu of a ferret killed sixty-eight hours after insemination. The ovum is surrounded by the remains of the corona radiata.

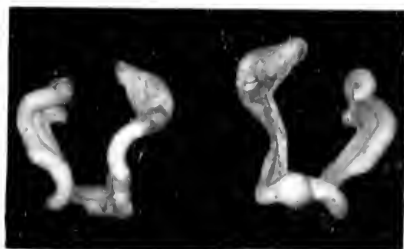
All the nuclear structures which would have been present in a normal ovum have disappeared. $\times 200$. Iron hæmatoxylin. Compare with Fig. 13b.

FIG. 13b. Section of a normal zygote, from the same uterine cornu as the ovum shown in Fig. 13a. $\times 200$. Iron hæmatoxylin. The zygote is in the eight cell stage, but parts of only three cells are seen in the section.

FIG. 14. A normal blastocyst, from a uterine cornu of a ferret killed six days after insemination. $\times 200$. Iron hæmatoxylin.

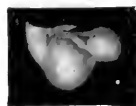


1



2 a

2 b



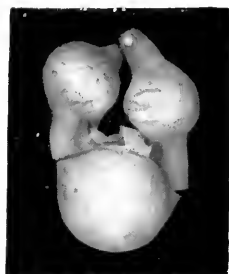
3



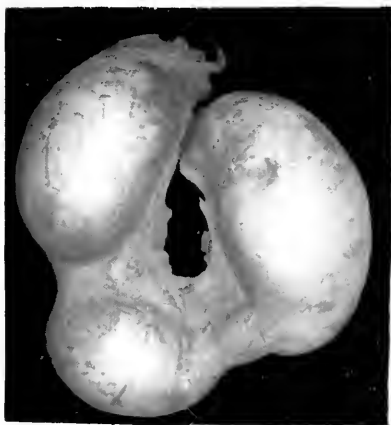
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5



6



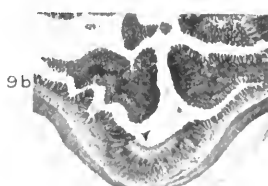
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7

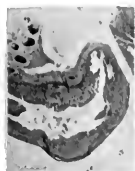


9a



9b

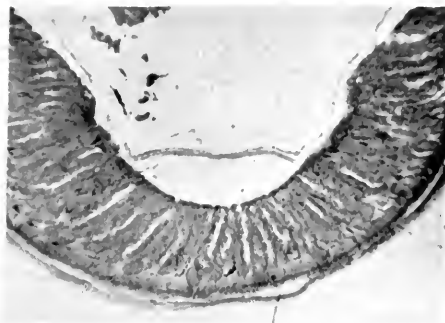




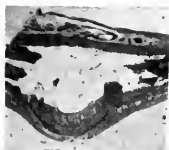
10 a



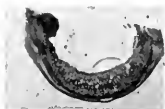
10 c



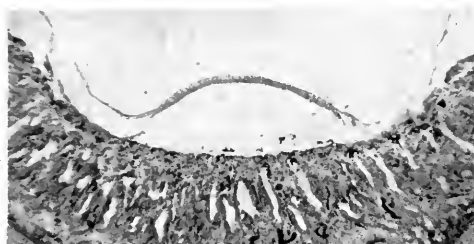
10 d



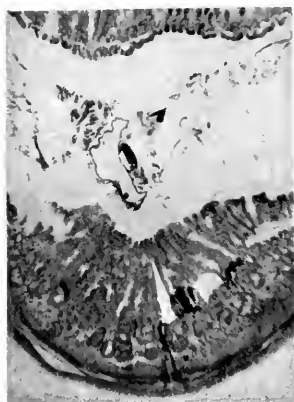
11 a



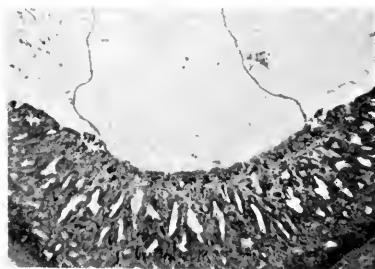
11 c



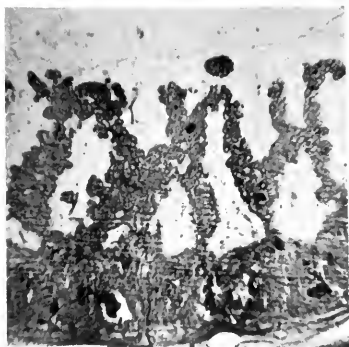
11 d



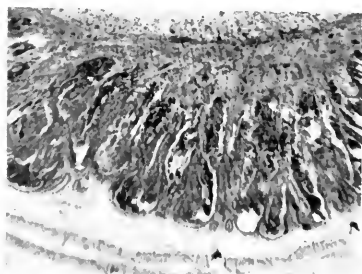
10 b



11 b

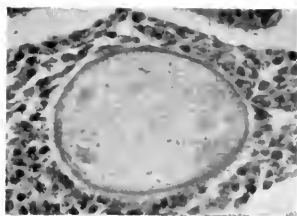


12 a



12 b





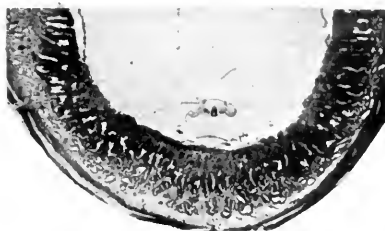
13 a



13 b



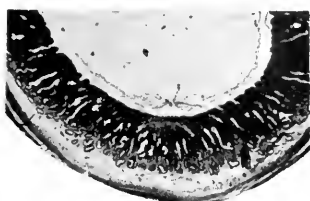
14



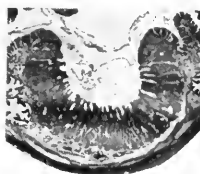
16 a



15



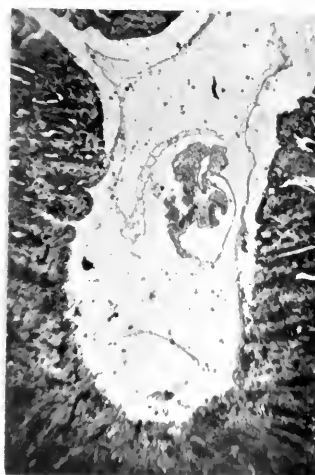
16 b



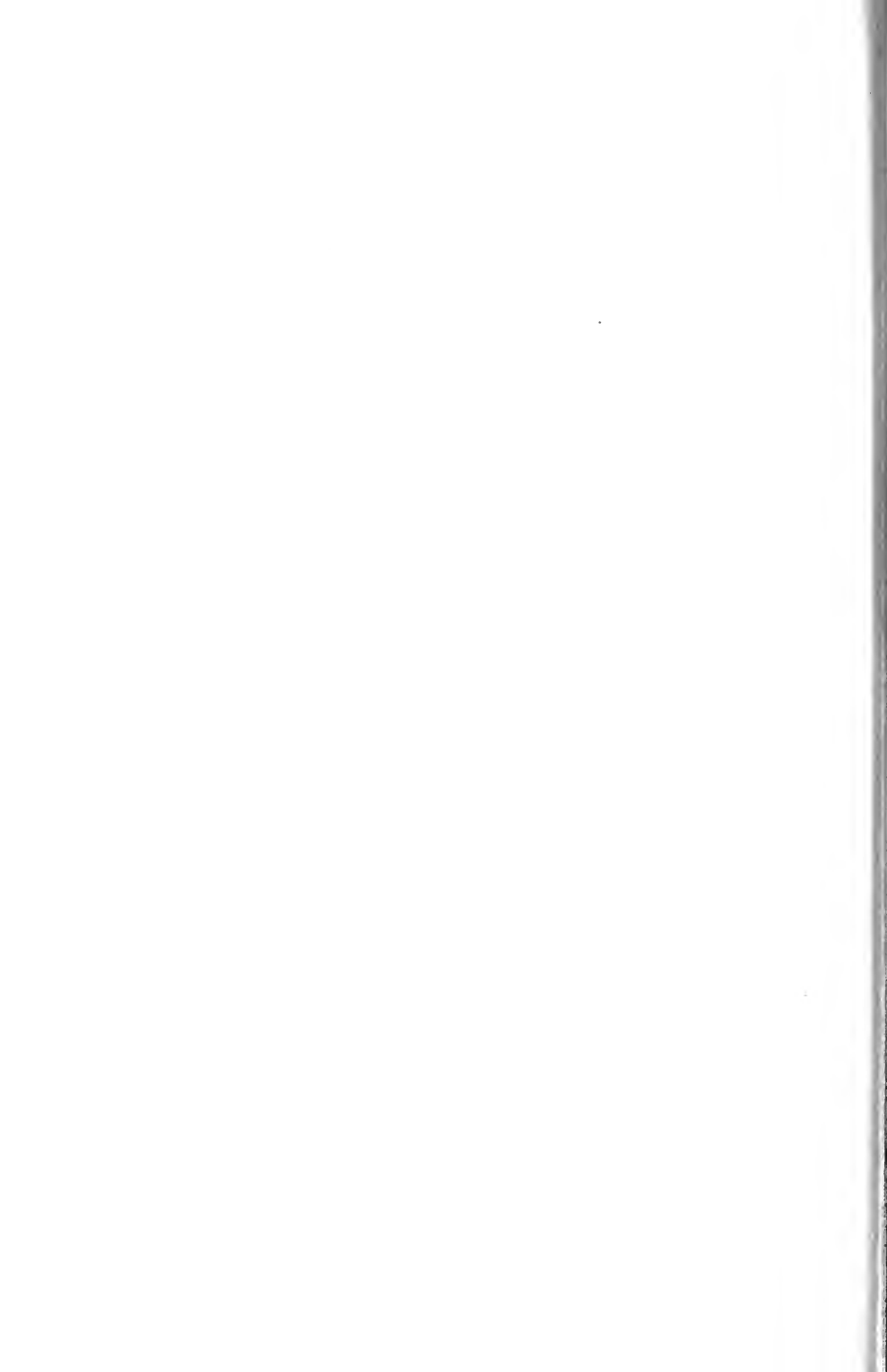
17



18 a



18 b



Prenatal Death

FIG. 15. A degenerate zygote, from a uterine cornu of a ferret killed fifteen days after insemination. $\times 200$. Iron hæmatoxylin.

The black masses around the oolemma are the remains of the persistent and degenerated corona radiata.

FIG. 16a. A portion of the ventral part of a normal gestation chamber of a ferret in the 17th day of gestation. $\times 4$. Hæmatoxylin eosin.

FIG. 16b. A portion of the ventral part of an abnormal gestation chamber, from the same uterine cornu as the specimen shown in Fig. 16a, showing an abnormal embryonic area with a blastoporic aperture in the middle of the embryonic region. $\times 4$. Hæmatoxylin eosin. Compare with Fig. 16a.

FIG. 17. A portion of the ventral part of an abnormal gestation chamber from another ferret in the 17th day of gestation, showing a blastoporic aperture in the middle of the embryonic region. $\times 4$. Hæmatoxylin eosin.

FIG. 18a. Part of the ventral portion of a normal gestation chamber of a ferret in the 17th day of gestation, showing a section of the caudal part of the embryo and the allantoic diverticulum from the hind-gut. $\times 20$. Hæmatoxylin eosin.

FIG. 18b. Section through an abnormal gestation chamber, from the same uterine cornu as the specimen shown in Fig. 18a, showing the abnormal narrowness of the gestation chamber, and the rudimentary condition of the caudal part of the embryo and the allantoic diverticulum from the hind-gut. $\times 20$. Hæmatoxylin eosin.

PHYSICAL THERAPEUTICS FROM THE SURGICAL STANDPOINT.*

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I PROPOSE to limit my remarks for the most part to those physical methods which have been found of value in the conditions seen at out-patient Special Surgical Clinics now dealing with disabled ex-service men. One is only too glad to think that this work must of necessity diminish in volume as time goes on, though I do not think it will do so anything like as quickly as some seem to think. But among civilian patients conditions similar in type though rarely so severe in degree do exist pretty widely, and it would be a pity if the lessons learned from war work were not applied as fully as they might be to days of peace. Both the experience and the highly trained staffs are there, and should not be wasted.

From the point of view of remedial as apart from operative treatment, we have to do in essence with four conditions:—

(a) Fibrositis and resulting deformities. The fibrositis may affect muscles or ligaments, or take the form of a contracted skin scar: it may result from suppuration in a wound, from splint pressure, from deprivation of blood supply or from injury to nerves; or it may be a result of "rheumatism." But whatever the cause, the essential condition is scarring of varying depth and of varying density.

(b) Loss of power in one or more muscles, due either to scars in the muscles themselves, to binding down of their tendons, to true paralysis from lack of innervation, or finally, to functional paresis from faulty cerebration.

(c) Nerve injuries. These have been defined and classified during the war years so fully, that I need not now detain you by any attempt to group them.

(d) Persistent sinuses or other unhealed wounds.

When seeing a new case, one's first thought naturally is, "does the case call for any further operative treatment either now or in the future?" That question out of the way, the next

* Communicated as the opening paper in a discussion on Physical Therapeutics at the Medico-Chirurgical Society of Edinburgh, 1st December 1920.

Physical Therapeutics

step is to lay out a clear policy; to define as far as possible what changes can be hoped for as a result of remedial treatment, and to discuss with the man how he stands, or will stand, at the end of his treatment as regards employability. The man alone knows what he wants his limb to do, and it is our duty to tell him whether there is any prospect of its being able to do it. If not, the sooner he lays his plans for some other walk in life the better.

The next and most vital point is to convey, preferably by word of mouth, all possible information to the masseuse who will treat the case. Unless this is done, nothing but dull, unintelligent work can be expected from her; patients make no progress, and your staff does not advance in education. To save time, I shall use the term "masseuse" whatever the form of treatment in question, and whatever the possible sex of the member of staff. Most of the Tynecastle staff are women, though we have had two men, both of them very good. There certainly ought to be a proportion of men on a large staff.

Massage.—Among the remedial measures at our disposal, one gives first place to massage. From the surgical point of view, its effects may thus briefly be summarised.

(a) It removes the products of inflammation (other than pus) even from such deep parts as joints. (b) It greatly improves the circulation of a limb for the time being, and after prolonged treatment does so permanently. As a collateral effect, it expedites the healing of sinuses and callous or varicose ulcers. (c) It relieves pain of a neuritic or rheumatic type, and relaxes muscular spasm. (d) In favourable cases and after varying periods of treatment, it has an amazing effect in "mobilising" scars and liberating them from adhesion to deeper structures. The scarring of the deeper structures themselves also yields if not too dense. (e) It improves the nutrition and development of muscles damaged by interstitial scarring or fibrosis.

In this brief summary, I have included the effects of different movements all covered by the generic term "massage." But it is of course effleurage which removes recent inflammatory products and relieves pain and spasm; deeper work, badly termed friction massage, which dissipates scars and adhesions; and kneading and vibrations which develop muscles.

A much discussed point is the wisdom of massaging muscles which have lost their nerve supply. According to some, the atrophy of denervation is the atrophy of fatigue, this idea being

J. Stuart Ross

of course founded upon Langley's work on fibrillation in denervated muscles. Heavily to knead and percuss over-tired muscles would appear definitely harmful, and in actual practice it is easy to do too much to a severely atrophied muscle. But that is a fault into which no well-trained masseuse will fall. Light work undoubtedly does much to maintain a good blood supply, and to keep the paralysed organ in a condition to benefit by the return of its nerve supply. And if indeed it is suffering from fatigue, all the more reason why it should from time to time have the products of fatigue massaged out of it.

Exercises.—A seance of massage is ordinarily completed by a certain amount of passive movement. In acute surgical cases such as recent fractures, the amount and nature of this will be strictly defined for each individual case by the surgeon. In cases such as seen at Tynecastle, too much must not be expected by passive movement. It is no doubt possible by its use to prevent the formation of adhesions, or even to stretch and dissipate those already formed if quite slender. Where the adhesions are dense and there is much fibrositis of ligaments, passive movement of itself effects little. For such cases, deep "friction" massage and the use of graduated splintage, later to be mentioned, offer much more hope. None the less, in suitable cases, passive movement does good. Assisted exercises, where patient and masseuse exercise force in the same direction, have the same effect. Personally, I prefer pure passive movement, if range of action in a joint is what is desired.

Active movements on the part of the patient other than mere assisted movements, have the dual object of increasing the range and the force of the movement, by developing the muscles. It is on the latter aspect that I wish to dwell for a minute.

Nature's way of restoring an enfeebled muscle is to give it work to do, and if the enfeeblement is not too extreme, there is no reason why we should not let nature have her way pretty freely. Exercises are at first done under the eye of the masseuse, and against no greater force than the weight of the limb. Later the resistance is increased by the hand of the masseuse, or by some mechanical device, such as Mennell's Exerciser, upon which the weight to be lifted as well as the duration of the exercise can be graduated very nicely. The exercises must of course be chosen carefully for each case, and their proper graduation is a good test of the intelligence and training of the masseuse.

Physical Therapeutics

Much more delicate and much more fascinating is the re-education of muscles which have only recently recovered their innervation. Such a muscle can only begin to work when placed under the most favourable circumstances. The force of gravity must be eliminated, and the attempt to move must start from that position which affords the greatest mechanical advantage to that particular muscle. Take the deltoid as an instance. It cannot begin to work with the limb hanging by the side and the body in the erect posture, but only when the man is laid on his back and the arm brought out from the chest to nearly the right angle. When a recently paralysed deltoid can, in the recumbent posture, move the limb from 80° to 90° , we can ask it to move from 70° to 90° , and so on, until it can take the limb out from the side to the right angle. Then only can we expect it to do a little work, say from 70° to 90° , with the body slightly propped up.

The same principle can of course be carried out with all muscles. For insistence upon all this we are indebted to Colin Mackenzie, as also for pointing out the necessity of relaxing the opponent of the feeble muscle. One sees cases where this point is very difficult to secure. In the forearm we often see finger flexion or extension hampered by over action of the opponents. The man throws the whole forearm into spasm, and instead of effecting movement, produces equilibrium. This fault requires lengthy re-education to overcome, even when the man has grasped the explanation which one gives him, of his difficulty. When, as is so often the case, the cause of difficulty is twofold, partly organic and partly functional, only a very intelligent man will make much of it. Several such cases one has had to abandon.

I am convinced that in the problem of dealing with muscles which have been deprived for a period of the nerve supply, there is much more than mere mechanics to consider. Subject to correction from neurologists, I take it that motor neurons, both lower and upper, suffer from disuse, and that part of the difficulty one sometimes (though not often) has in starting voluntary movement after nerve regeneration lies in lack of directing power from the higher centres. Such cases do better if screened off or taken into a side room, and they need the help of a right type of masseuse who can be at once patient, hopeful, and firm.

When the earliest stages of muscular recovery are past, it is wasteful to use one masseuse to supervise each patient. At

J. Stuart Ross

Tynecastle we now have two masseuses spending most of their time in giving class work. The men are suitably grouped, and the classes are not allowed to exceed six or seven at the very outside. Four is really enough. Unfortunately, our space is too confined for anything very ambitious in the way of gymnastic appliances, but even without them we get very good results. Men sent for treatment for our old Army enemy, "Disordered Action of the Heart," or for breathing exercises, are kept separate. They are dealt with on the lines of the Report of the Medical Research Committee on this subject.

The question of a curative workshop was very carefully considered by the Tynecastle Sub-Committee of the Joint Disablement Committee. Among pensioners, such departments are not so easily run as among enlisted men, but that aspect of the case would not have deterred us. In another of the Scottish Annexes, a workshop was run for many months with great success, and the thorny problem supposed to be so likely to crop up, of men being asked to "work" without wages, was not I understand at all troublesome. What did decide us against the attempt was the opinion formed by several of us (the last being my colleague, Dr Darling, whom we sent on a tour of inspection) that men in curative workshops very often simply dodge their deformity instead of remedying it. With the best will in the world, a man who has lost a function of one of his limbs will compensate for that loss by finding some other way of effecting his purposes if it be possible, rather than painfully and slowly redevelop his lost movement. That is what most men do when training for a new occupation or resuming an old one: and if that is all that, from the nature of the case, we are able to offer to the man, then the sooner he is out of the treatment centre the better.

Exercise for functional cases are in a sense psycho-therapy, not physical-therapy. But organic and functional are often present in one and the same man, and the functional is slow to recover unless the organic is successfully dealt with. If the two can be treated at one and the same time, by exercise alone, so much the better: for passive treatment such as massage and electricity for the organic lesion, may well confirm the complex on which the functional one rests. In cases where this is impossible, one can only explain affairs as clearly as possible to the patient and hope for the best. Much will then turn upon the man's intelligence. I have in mind the case of

Physical Therapeutics

a man who arrived at Tynecastle diagnosed as sciatica. He walked in with the aid of two sticks; his lumbar spine was in a condition of extreme lordosis, and his lower limbs were spastic. He undoubtedly had at one time had fairly severe sciatica, but there was on admission small sign of any real persistence of that condition. There were also no signs of any organic nerve lesion. The man was fortunately a very intelligent artisan with a good trade available to him as soon as he could work. Once his condition had been explained to him, he was fully convinced of the truth of what was told him. After a few weeks of re-education, he was able to discard his sticks and walk in a natural way, and at his own request was allowed to return to work. While employed he had some return of the sciatic pain and promptly relapsed to his former functional gait. Seeing that he perfectly understood his condition, one had no hesitation of allowing him the luxury of some passive treatment (radiant heat and massage) in addition to a second course of re-education. Although he was apparently cured again in a few weeks, we insisted this time that he should remain on treatment for about three months. He had a full course of Swedish remedial exercises, and was sent for a holiday. He has now been discharged for some months and has not reappeared, so I hope that this time he will stand up to the strain.

Before leaving the subject of exercises, I would like to say a word about the use of the term Swedish Remedial Exercises. Though the credit for the initiation of this form of treatment does not belong to Sweden, that country has undoubtedly done more than any other to codify and improve it. But grave blunders have been made. The Central Institute has taken a line antagonistic to the medical profession, and to all intents and purposes offers to the public the services of its diplomates as an alternative to, rather than a part of, medical treatment. Guided by sound medical advice, this form of treatment can do much good work both remedial and educative, but divorced from it, is likely to become tinged by quackery. In this country we have been on our guard against such developments. A fair number of British men and women are being now turned out by the training centres in Scotland and England, who do not, so far as I have heard, exhibit the unfortunate tendencies inculcated in the Stockholm Central Institute.

Before leaving the subjects of massage, muscular re-educ-

J. Stuart Ross

tion, and remedial exercises, I must, in the absence of my colleague, Dr Rainy, refer to their use in medical as opposed to surgical conditions.

The *Use of Massage* in such conditions as convalescence from illness or operation, in neurasthenia and in constipation, is well known. I venture to think that in the matter of convalescence after operation, massage is not as freely used as it should be. Its liberal use might perhaps take the place of the policy advocated by some surgeons of getting their abdominal section cases up at a much earlier time than is usual in the average practice. I hope this point will be discussed by others.

Re-education of muscle-sense in such conditions as tabes is of course well known. There is no doubt that the exercises devised by Fraenkel do something to alleviate the hard lot of the tabetic. This afternoon I was watching one of my S.R.E. masseuses re-educating the hands and arms of a man who was formerly believed to be suffering from neurasthenia only, but who is now considered to be a case of disseminated sclerosis. Tedious it may be, but the progress is definite, and will make a difference in the man's ability to look after himself.

I have had personal experience of re-educating some cases of recovering poliomyelitis. Done upon the principles laid down by Colin Mackenzie, and assisted by appropriate splintage to rest the affected muscles, much can be made out of even a badly affected limb. I would also like to refer to the treatment of cases of rigid chest-wall and chronic bronchitis and emphysema by massage and Swedish remedial exercises. The various movements of assisted breathing exercises, chest slappings, and liftings, do certainly increase the mobility of the chest-wall, and assist both mechanically and reflexly the interchange of gases within the lung. This point also, I hope, we shall have discussed by physicians who have more experience in such cases than I have.

Electrical Treatment.—The only two forms of this treatment of which we make extended use are galvanism and faradism. Sinusoidal current is also available, and in some cases it certainly relieves the pain of a neuritis. It is also a sovereign remedy for chilblains, and like most sovereign remedies sometimes entirely fails. But I would not like to be without it. Diathermy is one of the most striking of all physical methods, but opinions seems to differ markedly as to its

Physical Therapeutics

utility. We do not have an installation at Tynecastle, nor have I worked with it elsewhere.

Galvanism we use in three forms: ionisation, galvanic Schnee baths, and interrupted galvanism for denervated muscles.

Ionic treatment with chlorine or iodine under the kathode certainly assists in the loosening of scars if not too deep, and quite definitely improves cases of synovitis in joints reasonably accessible. Rheumatic pains are also relieved by ionisation with salicylate of soda under the kathode or sulphur under the anode. In cases of open wounds or sinuses, striking results are sometimes obtained. One can usually rely on the discharge being much lessened by it, and healing is expedited. One man came with a wound through the brim of the pelvis from front to back, which had discharged for more than twelve months. Fluid could be propelled freely from one sinus to the other by a syringe. It may have been chance that he healed in a few weeks with an ionisation once a week, but in view of the history it looks like cause and effect. I need hardly say that we do not expect ionisation to close a sinus which has a sequestrum at the bottom. The two drugs we use for sinuses are brilliant green and ichthyol, both of which are repelled by the anode. For an open ulcer, zinc or copper salts give as good results as anything.

Galvanic limb baths, or baths with a combined galvanic and faradic current, are by some regarded as useless. I do not agree. If the poles are so arranged that the current must really enter or leave the bath *via* the tissues of the limb, it is certain that everything within the skin sheath must get its fair share of it, nerves and muscles all getting their dose; and if that has no effect upon their nutrition, how is it that after a short bath it is possible to obtain galvanic response in the muscles with far greater ease than it was in the same muscles before the bath? As to the improved sensation which during nerve regeneration follows a bath, and persists after it for many hours, the patient is the best judge. Many men employed during the day find it well worth their while to spend some of their leisure time in the evening in having a combined bath. We may take it that if they felt no comfort from it, they would not attend so regularly as many of them do. If it is improvement of recovering sensation which is desired, I like a combined bath, with the galvanic element kathodal for

J. Stuart Ross

most of the time, but reversed for a minute or two several times during the treatment.

But undoubtedly the securing of muscular movement is the great desideratum in galvanic treatment. It is true that by this method you get a part only of the muscle to contract, but even that is better than nothing. Muscular atrophy will not entirely recover until the nerve supply is re-established; but any man with paralysed muscle groups who for some reason has had to intermit his galvanic treatments, will tell you that the part is quite definitely more shrunken than it was while under treatment.

Since theoretically muscles which react to faradism can, save in functional cases, also be made to contract by volition, one would anticipate that muscles could be redeveloped as well by exercises as by faradism. Theory does not, however, here coincide with experience. Such small muscles as those of the hand supplied by the ulnar nerve are far more easily developed and exercised by faradism than by voluntary movement, and in most cases it is not until this process has been carried on for some little time that reasonable voluntary movements of sufficient force to help in the redevelopment can be secured.

The improvement of the intrinsic muscles of the foot is apt to be overlooked. If in flat foot these muscles are never primarily responsible, they are at any rate frequently guilty of contributory negligence, and a number of cases of flat foot have been relieved at Tynecastle by the use of the faradic foot bath. The water is quite shallow, even the dorsum of the foot not being immersed; both poles are brought into the bath and the foot lies in the current stream between them. If then the current be "surged" by moving in and out the core of the Bristow Coil, all the short muscles in the sole are made to contract. The bath is given for five to ten minutes; longer treatment might produce over-fatigue. The results in mild and early cases have been really excellent.

Even in large muscles faradism will often secure development to an extent which has not been achieved by voluntary movement even after some months. The quadriceps is a notable example, particularly the vastus internus part of it, as has been repeatedly pointed out.

Of faradism as a means of maintaining the muscles during the recovery from a recent fracture, I have but a limited experience. I hope we shall hear more from some surgeons

Physical Therapeutics

who have given it a fair trial. What struck one when using the method was the facility with which the masseuse or oneself could give the necessary treatment without interfering with the splintage, as compared with massage for the same purpose. With the Thomas splints so widely used during the war, practically every motor point of importance was got at with the greatest ease. As with so many other things tried in France, however, one was under the disadvantage of not being able to follow up one's cases.

May I be allowed for a moment to touch upon the question of the **resumption of industrial occupation** after severe muscle or nerve injuries. Pressure to this end does not by any means always arise from one side. In these days of high wages for certain occupations a man able to follow a good trade is not at all anxious to remain off work; it is the unskilled man with whom one has difficulty, or, as commonly, the man who from an irremediable disability is no longer able to work at his former skilled job. This is undoubtedly the hardest case of all, and the nation should take the problem in hand much more thoroughly than it so far has done.

Let us, however, leave aside the social and return to the surgical aspect. Take forearm lesions of the median or ulnar nerves below the source of supply of the main mass of the forearm muscles. Many such cases can after nerve suture go back to an occupation which does not demand from the affected hand the finer movements of the fingers or a proper sense of touch. This policy was pursued fairly freely up to about 1916; the man was told to use his hand and that nature, assisted by the operation performed, would do the rest. These cases are now being seen by Boards and treatment centres, and the results in many cases have been deplorable. The fingers are stiff, with hyper-extended metacarpo-phalangeal and tightly flexed inter-phalangeal joints, while in other cases the long flexor tendons also are contracted. At that late stage, treatment to be effective must be very prolonged, and usually involves taking the man off his work. That use of such hands after a reasonable interval for post-operative treatment is beneficial I should be the last to deny, but it must be accompanied by proper supervision, by as much treatment as the man can find spare time for, and, above all, by the wearing of a light splint to keep the fingers in good position during the hours of rest. I hope to illustrate this point especially, by the lantern.

J. Stuart Ross

We were, as I have said, a little slow during the war to realise that it was not always good economy to hustle a man back to work, and I question whether even now we have fully applied the moral to industrial injuries. Legal and financial questions play in them so overpowering a part that the real medical question of how best to secure speedy and complete recovery from the injury is hard to keep a grip upon. Time, work, and cessation of compensation often work wonders in completing the cure of a bad back or a sprained joint, but would all these cases take quite such a long while to get better if timely massage, electrical treatment, and remedial exercises were more widely available. Their effects, both physical and psychic, are enhanced if given a chance at a time precedent to the date at which the insurance society begins to kick at the duration of the period of compensation. The feeling on the part of the man that "all had been done that could be done," and that from the very beginning of his injury every modern treatment had been used to expedite his recovery, might make a vast difference in his outlook and prevent the development of traumatic neurasthenia. Proper remedial treatment carried out under skilled supervision would, to put the matter at its lowest, shorten many a period of compensation. Put it on the highest and proper plane, it would prevent many a good man suffering chronic pain and chronic depression.

Thermo- and Photo-Therapy.—In a radiant heat bath as ordinarily given, various forms of rays are present. With lamps giving a sufficiency of actinic as well as heat rays, very great relief can be secured in a radiant heat bath for rheumatic and neuralgic conditions. Above all, the part is brought into a condition which gives massage a fair chance, and it is largely for this purpose that we use it in orthopædic work.

We have recently installed a large paraffin bath. In this a temperature of 120° to 125° F. can be borne without difficulty, but care must be taken that cases with marked trophic conditions of the skin are not allowed to use it. The sensation of warmth and the increased pliability of the limb certainly last longer than after a radiant heat treatment, and the limb is after it in a perfectly ideal condition for massage or passive movements.

Graduated Splintage.—This method of treatment is essential in the late stages of injuries, such as are seen in pensions work to-day. A joint limited in range of movement from scarring in the extra-articular tissue or fibrosis of the

FIG. 1.



FIG. 3.



FIG. 2.



FIG. 4.



FIG. 5.





Physical Therapeutics

ligaments themselves will not yield to mere movement whether active or passive. Operative surgery occasionally offers some prospect, but usually the only course is to stretch the scar bound tissues by graduated splintage. Almost every case offers its own problems and a few examples only need be referred to in detail.

Fig. 1 shows a splint we have found very useful for improving the extension of the elbow. It is simple, light, and inexpensive, and we prefer it to the alternative method of successive plasters.

To secure dorsi-flexion of a wrist, the splint shown in Fig. 2 has done very good service. The hand rests on one padded plate, the forearm on the other. The two plates are connected by strong lateral bars. A bandage passes over the back of the wrist, a suitable pad intervening. Each end of the bandage passes first under, then over, the corresponding lateral bar, and the two are then tied tight together over the back of the wrist, as tightly as can be comfortably borne by the patient. As the joint gives, the pad over the wrist is increased in thickness. The case illustrated in Fig. 2 has made great progress and will shortly be able to dispense with the appliance. I first saw this splint at Alderhey Hospital.

Of all joints which require splintage the metacarpophalangeals are the most difficult, and are certainly not the least important. As the result of neuritis their ligaments are often so fibrosed as to leave hardly any range of movement at all. The joint is usually rigid in extension, and many of our men have not seen their knuckles for years.

Some form of traction with rubber bands seems the most natural way to secure flexion, and the chief problem has been to find a *point d'appui*. An appliance fixed to the forearm with hooks to which the rubbers may be attached is apt to be pulled down by the tug, and so loosen the rubbers.

Fig. 3 shows a papier-maché splint specially made for the man, which get its grip in the forearm by the accuracy of its apposition to the forearm and hand, and has proved very satisfactory. The joints in this case are after a few weeks' use of the appliance already beginning to yield in a very gratifying way.

Fig. 4 shows another view of the same appliance. This splint, together with the next to be described, is kindly made for us by the Surgical Requisites Association of Eglinton Crescent, Edinburgh. The idea of the aluminium "bridge"

J. Stuart Ross

is to get the pull in the right direction, for when the splint was first made the metacarpo-phalangeal joints were rigid in extension. As the hand is to-day the bridge is almost unnecessary, for a position of 135° flexion has already been attained and the bridge can be lowered or dispensed with altogether.

Another device for getting the necessary grip on the forearm is the leather lacing wristlet shown in Fig. 5. It is stiffened with metal, front and back, so as to maintain the wrist in dorsi-flexion, and is provided with hooks for the rubbers. In the case figured a glove is provided, so that the pull comes over the interphalangeal joints as well as the metacarpo-phalangeals, but those forearm appliances can also be used with the same type of finger attachment as is shown in Figs. 3 and 4.

HUMAN GESTATION AND OUR EMBRYOLOGICAL AND MORPHOLOGICAL DATA.

By JAMES OLIVER, M.D., F.R.S. (Edin.).

NO one who has given any attention and thought to embryology and morphology can possibly be satisfied with the unsound and unscientific method whereby it has been and still is customary to reckon the age of any given human embryo and assign dates to the various depicted stages of our embryonic development. With a certain amount of satisfaction and success we have, it is true, from time immemorial been accustomed to reckon and fix accordingly the probable date of parturition in any given case of pregnancy from the day of cessation of the last menstrual discharge, purely and simply because under ordinary circumstances menstruation is invariably held in abeyance during pregnancy. Now there can be little or no doubt that on account of the modicum of success resulting from the aforesaid method of prognosticating, there prevailed at one time and even still lingers the belief that fertilisation was and is most commonly effected immediately after a menstrual period. This undoubtedly is somewhat remarkable, for it was well known that although the Jews were a prolific race the strict Jewess, at least in olden times, adhered to and observed the Mosaic law which forbade her to have intercourse with her husband until she had numbered seven clear days from the cessation of her menstrual discharge and had had the prescribed bath. To-day, however, because of abundant clinical proofs, it is very generally admitted that fertilisation may occur at any time during the intermenstrual resting period, *i.e.*, the period extending from the cessation of the menstrual discharge of one "unwell time" to two days prior to the date of the next expected menstruation, when there is in anticipation of and as a preparation for the occurrence of menstruation an increased determination of blood to the internal organs of generation. It is, moreover, perfectly evident that as in the case of the vegetable seed and the bird's egg fertilisation endows the human ovum with the power of evolutionary life but does not start life, consequently fertilisation and the beginning of gestation are not coetaneous phenomena. If fertilisation and the commencement of gestation were synchronous events then, because fertilisation may take place at any time during the intermenstrual rest period, it would

James Oliver

be futile and hopeless for us ever to attempt to forecast the date of the birth of any expected infant.

With a large percentage of women the menstrual cycle ranges from twenty-four to twenty-eight days, and because of this the measure of success obtained by reckoning the probable date of confinement from the cessation of the last menstruation is due entirely to the fact that in the case of every woman who conceives gestation begins at a definite and fixed time, and this definite and fixed time is the two days preceding the date of the menstruation next expected after fertilisation has taken place, and which is also the first menstrual period held in abeyance because fecundation has occurred. Here the success is merely due to the fact that in a large percentage of women the menstrual cycle ranges from twenty-four to twenty-eight days, and that the fixed and definite time for the commencement of gestation is so commonly included in such a cycle. With a not inconsiderable number of women, however, the menstrual cycle ranges from thirty-one to forty-two days, and clearly it is futile for us to base our calculations of the duration of gestation in such cases as in the case where the menstrual cycle ranges from twenty-four to twenty-eight days on the date of cessation of the last menstruation.

Already I have on several occasions drawn attention to the fact that as in the case of the fertilised vegetable seed and the fertilised bird's egg evolutionary life in the fertilised human ovum is started not by intrinsic but by extrinsic conditions, and one of the most important of these is an abundant supply of free oxygen. Now during the intermenstrual resting period the oxidative processes and powers of the uterus are merely sufficient for the requirements of this organ itself, but in anticipation of and as a preparation for menstruation the oxidative processes and powers of the internal organs of generation become enormously increased, and if a fertilised ovum should chance to be present it is at this time that it is fanned into life.

Taking all the aforesaid pronouncements into consideration, it is somewhat astounding that embryologists are still content to adopt and follow the avowedly unsound and unscientific method of reckoning the age of any human embryo, and assigning dates to the various depicted stages of our embryonic development from the date of cessation of the last menstrual discharge.

CLINICAL RECORDS

A CASE OF PRIMARY BRACHIAL NEURITIS TREATED BY STRETCHING OF THE CERVICAL PLEXUS.

By DAVID M. GREIG, C.M., F.R.C.S.Ed., Conservator,
Royal College of Surgeons, Edinburgh.

IN the *British Medical Journal* for June 1919, brachial neuritis received consideration by Dr Williamson from a medical point of view, but though eleven cases are there reported in more or less detail, no suggestion is made as to the advisability of surgical interference. It is certain that primary brachial neuritis is not a condition which commonly comes under the observation of the surgeon, whereas secondary brachial neuritis frequently does, and the treatment of this secondary condition resolves itself into the removal, when possible, of any obvious cause, or into the modification of the provocative constitutional disturbance.

Though primary brachial neuritis is as much an entity as sciatica, it is certainly not given the same specific prominence in text-books, but when mentioned at all it is classed with "neuritis" generally, and so any individuality due to it, obscured. On the other hand the attention given to sciatica may be unduly specific, but if that be a fault, it is to some extent doubtless due to the very decided crippling effects of that complaint. It is illogical not to equally particularise brachial neuritis in which the crippling effect may be as severe as in sciatica, though the lameness, being of the upper extremity, is not so obtrusive to general observation.

The typical symptoms of primary brachial neuritis are embodied in the following case:—

J. W., a joiner to trade, married, and with a healthy family, was a man of regular habits, a life-abstainer from alcoholic drinks, and moderate in the use of tobacco. In 1888 he had a severe pain in his right side (loin?) during a day or two and had to get morphia injected for its initial relief. In 1903 he had a right suppurating olecranon bursitis following a fall on the ice. Neither of these illnesses has given subsequent trouble. He was in fact a healthy, well-developed man without a trace of nervous or hysterical temperament.

In 1907, at the age of 53, he was referred to me suffering from pains

David M. Greig

about the left shoulder and arm of two years' duration. There was no history of any preceding traumatism to the shoulder and the onset had been quite insidious. Ill-defined, intermittent and slight at first, the pain had reached such severity in July 1906 that he had to give up his work. He was then two weeks in bed and five weeks subsequently at home before he attempted to work again. During the latter part of that period there appears to have been considerable improvement, an improvement which is usually found when primary brachial neuritis is treated by rest alone. Co-incident with his return to work, however, the pains reasserted themselves and he had to cease work again about the middle of December 1906. Medicinal treatment appeared to have had little effect, salicylates, quinine, aspirin, and phenacetin had been tried in turn and in combination without definite improvement, and in March 1907 he came under my observation.

The pain was then "almost always present" but worse when not resting in bed, and indeed there were certain positions in bed in which he was "practically free from pain." The pain commenced about the superior border of the left scapula and the application of blisters there had been followed by a modification of the discomfort. From there the pain passed to the deltoid region round about the shoulder and had at times been very severe in the belly of the biceps muscle. He said he had had formication down the back of the forearm into the hand and digits, especially the backs of the middle and ring fingers.

The symptoms were entirely subjective. The general nutrition was not obviously impaired. Nor was there any interference with the mobility of the limb. It was striking that though the neuritis had existed during two years there was no muscular atrophy apparent. The reflexes were normal and there was no anæsthesia. Deep pressure in the neck on the left did not cause more discomfort than when applied to the right side. The endurance of both the patient and his physician was exhausted and it had become necessary that something more would require to be done than rest and nerve sedatives.

In March 1907, under chloroform anæsthesia, I cut down on the cervical plexus through an angular incision, the angle being at the junction of the clavicle and the sterno-mastoid muscle as if I were about to ligature the second part of the subclavian artery. The cords of the plexus were quickly and easily defined, and I passed my right index round the nerve trunks and thoroughly stretched them. Experience in stretching the sciatic nerve enabled me to gauge what "pull" could be safely applied. The nerve trunks could easily suspend the weight of the thorax, head, and neck.

The operation was followed by striking results, as during the six subsequent days he was entirely free from pain, "a numbness"

Primary Brachial Neuritis

in the index finger being the only thing he noticed. Each night he had slept well and been quite comfortable. The wound being healed, the stitches were removed and a fresh dressing applied. Whether the reapplied bandages failed to maintain the same immobility, or the nerves resented handling of the limb, or that an unappreciated anæsthesia caused by the stretching was passing off, the dressing was followed by a recrudescence of the pain so that during two nights he did not sleep. The pain about the joint, the back of the arm, along the radial aspect of the forearm into the index and middle fingers continued in a modified degree during a fortnight, after which it gradually subsided, the forearm being supported in a sling. In November of the same year he had a "suspicion" of discomfort about the shoulder with numbness in the left index and back of the hand. This he ascribed to damp weather, but that discomfort too gradually disappeared, and during the past twelve years he has had no recurrence and has remained well, though he has changed neither his work, his habits, nor his residence.

While not wishing to claim too much for surgical interference, and while alive to the possibility that the absolute immobility of the limb after the operation may have materially contributed to the relief of symptoms, it appears to me probable that the early termination of the two and a half years' neuritis which followed the operation was more than a coincidence, and that the surgical interference deserves some credit for the satisfactory result. It is a treatment to be borne in mind in recalcitrant cases of primary brachial neuritis.

W. E. Foggie

A CASE OF PERIPHERAL NEURITIS OCCURRING IN PREGNANCY.

By W. E. FOGGIE, M.D., Dundee.

THE following is a brief record of a disease which is only an occasional accompaniment of pregnancy. The patient was seen by me twice during the height of her ailment.

CASE.—Mrs B., aged 26, who had always enjoyed good health, although she was of a somewhat nervous temperament, became pregnant one month after her marriage. When she was first seen she was $4\frac{1}{2}$ months pregnant. At the end of the first month of her pregnancy, sickness, pain, and vomiting set in very violently and continued for two months. She became very exhausted and emaciated. Her memory failed and she was at times delirious. Treatment at this time was evidently directed largely to the relief of a very obstinate constipation from which she suffered (the bowels generally only moving once a week).

After two months the condition of hyperemesis passed off, but she noticed that while she was still in bed she was unable to move her legs. She had also become aware a little earlier of a numbness about the hands, with a constant desire to rub her hands to restore the circulation. There was also a numb feeling in the legs.

During the last month or so there has been some improvement in her own general condition, and also a return of some power to her limbs. She has been mostly confined to bed, but from time to time her friends have been getting her up for a little and supporting her across the room to a chair.

Nervous System.—At the date of examination (Aug. 1897) she was still pale and emaciated. She spent most of her time in bed. The muscles in general were soft, flabby, and wasted, but apart from this there seemed to be wasting, especially in the calves and the forearms. She was unable to stand, and when supported merely dragged her legs along without any attempt to raise them. There was a complaint of numbness in the fingers and also in the legs where it reached up to the knees. There was pain in gripping the calves firmly, and this was also present to a slight degree in the arms. There was an impaired feeling to touch over the hands and fingers up to the wrists. In the legs this impairment extended up to the knees. An electrical examination was not possible. The grasp was feeble. As the patient lay in bed she was able to pull up the thighs but could only get them down by a side movement. There was no difficulty in resisting this or any other movement in the lower limbs. She was unable to extend

Peripheral Neuritis occurring in Pregnancy

the leg at the knee and could only flex feebly. She had slight power of moving the feet and the toes. If seated, she had great difficulty in rising.

There were no reflexes at the wrist. The knee-jerks were absent, and also the Achilles jerks. No ankle clonus could be elicited.

Circulatory System.—Pulse was 96, soft, regular, and of low tension. The heart was slightly enlarged. There was a systolic murmur in the mitral and pulmonary areas.

Alimentary System.—The tongue was clean. The bowels were now kept regular. She was able to take light food. The abdomen was lax. The liver had its upper border at the 4th rib and the lower at the 6th, thus to percussion apparently quite small. The uterus was enlarged and corresponded to a pregnancy of $4\frac{1}{2}$ months.

Respiratory System.—There was nothing abnormal.

Urinary System.—The urine, which was high-coloured during the stage of hyperemesis, now showed a specific gravity of 1026, was acid, amber in colour, and had a trace of albumen. There was a deposit of urates.

The patient was delivered of a healthy living child at full time. The various symptoms continued throughout the pregnancy but cleared up completely about four months after the birth.

The patient, who became a widow some years after, had no more children.

The above case represents one of the rarer nervous complications of pregnancy. It shows a typical general peripheral neuritis of which the main interest centres around its relation to the pregnancy. All the usual causes of neuritis such as infectious disease, poisons (metallic and organic, etc.), could be excluded.

It is then to be considered as an idiopathic neuritis definitely related to the pregnancy and not as a mere coincidence.

The record of cases of peripheral paralysis occurring during pregnancy and the puerperium has gradually been accumulating. There is now quite a substantial number of such paralyses, so that it has been possible for a general review to discover some at least of the factors which bring them about, or to see some of the states which favour their presence.

The whole subject has been reviewed in a comprehensive way by v. Hösslin,¹ who has thrown much light on the nature of the condition. He considers that, apart from local pelvic paralyses due to mechanical effects or to inflammatory extension, such paralyses are a result of infection or are of toxic origin.

W. E. Foggie

The present case is one in which septic infection can be definitely excluded, and its place is thus amongst the toxic sequelæ of pregnancy. Peripheral neuritis of pregnancy and the puerperium may affect only one nerve region, or it may show many combinations of nerve lesions, or lastly it may, as in this case, involve all four extremities. V. Hösslin considers the puerperium should also be included, as many cases begin in the course of pregnancy, and continue into the puerperium, and further cases may begin in the puerperium and yet be the sequel of conditions arising during the pregnancy.

This case agrees with the 46 cases of general neuritis of all four extremities which he analyses. Clinically it is almost an exact counterpart of the type of peripheral neuritis so frequently met with in alcoholic neuritis. Pathologically the underlying condition has been found to be a degeneration of the affected nerves.

Good surveys of the condition will be found in the papers of Turney,² Reynolds,³ G. Elder,⁴ and others. Elder, in his communication before the Edinburgh Obstetrical Society, describes two mild cases, one affecting only the upper extremities and the other both upper and lower. The subsequent discussion showed it was considered a somewhat rare condition. The speakers in general looked upon alcohol as the causal factor. Later work all points to the certainty of its occurrence apart from alcohol in many instances.

In addition to the peripheral neuritis there are two points of interest, viz.: (1) the associated hyperemesis, and (2) the mental phenomena.

1. Hyperemesis occurred nineteen times in v. Hösslin's 92 cases of peripheral paralyses of every distribution, and sixteen of these were present in his 42 cases of general neuritis, *i.e.*, in 34 per cent. It is hence in severe cases that it appears.

2. The mental phenomena noted in this case have been mentioned in many reports of such cases. Here it takes the form of loss of memory, but in others the mental changes are more outspoken and typical of the so-called Korsakow syndrome.

The whole neuritic condition can be best explained as resulting from a circulating toxin which leads to a degeneration of the nerves. It is apparently due to an unknown toxin of

Peripheral Neuritis occurring in Pregnancy

autogenous origin possibly arising from defective metabolism associated with excretory defect in bowel or kidney, occurring in the pregnant state where even in health there is so great a strain on the bio-chemistry of the body. It is just in keeping with this view that in these severe cases of widespread paralyses there should be such a proportionately large number of patients showing hyperemesis, as it also is generally reckoned as a toxic effect with like etiology. In short, the neuritis and the hyperemesis, so frequently associated in severe cases, are but the expression of phenomena due to the same underlying unknown toxin.

Treatment resolves itself into active regulation of the bowels, and improvement in the action of the kidneys. In most cases the neuritis clears up with the means usually employed in such cases. The prognosis is generally good unless the neuritis affects any nerves vital to life.

As regards the necessity of inducing premature labour, v. Hösslin considers it is only called for if the neuritis extends to nerves which threaten life because delivery does not always mean the rapid amelioration of the patient.

REFERENCES. — ¹ V. Hösslin, *Die Schwangerschaftslähmungen der Mütter*, Berlin, 1905, pp. 202-239. ² Turney, *St Thomas Hosp. Rep.*, vol. xxv. ³ Reynolds, E. S., *Brit. Med. Journ.*, 16th Oct. 1897, p. 1080. ⁴ Elder, G., *Trans. Edin. Obstet. Soc.*, 1896-7, vol. xxi., p. 242.

CRITICAL REVIEW

SURGERY OF THE GALL-BLADDER AND BILIARY DUCTS.

By JAMES M. GRAHAM.

Diagnosis.—In discussing the symptoms and signs of gall-bladder disease, Cheney¹ concludes that the well-tried methods of examination and the history of the case are the most reliable means of diagnosis. Any available laboratory or instrumental aid to diagnosis should be used, but most reliance must be placed on what the patient tells of his own symptoms, and on the physical signs present. The gastric secretions are frequently abnormal in gall-bladder affections, but there is no typical change which is diagnostic; either hyper-acidity or hypo-acidity may occur. The symptoms of indigestion in gall-bladder disease have usually been attributed to pyloric spasm, and this in its turn to an increase of hydrochloric acid in the stomach.

Fravel² reports the gastric findings in 61 cases of bile-duct infection with and without stones. Of the total cases 16 showed an absence of free HCl, 45 cases showed free HCl of less than 20, 11 came within the finding of normal, and only 5 cases showed an increase of free HCl.

While these observations differ from what is usually described, there is an increasing number of articles appearing in which a low percentage of hydrochloric acid is reported in gall-bladder cases.

Rydgaard³ found achylia in 47.4 per cent. of Rovsing's cases of gall-stones which were later operated on; 74 per cent. of the cases of stone impacted in the cystic duct had achylia or hypochylia. In some cases the achylia developed only when the cystic duct became blocked.

Fravel suggests that hypo-acidity may be the result of the loss of a hormone that is secreted by the normal gall-bladder. Hohlweg⁴ has observed that patients after cholecystectomy not infrequently returned with stomach symptoms, and that 83 per cent. of these patients show a deficiency of hydrochloric acid.

The apparent relation between the integrity of the gall-bladder and the gastric secretions, suggested by these observers, is a good reason for conservative surgery.

Rovsing is convinced that the gall-bladder is a physiologically important organ, and that it should not be removed without imperative indications. Even a recurrence of stones is not regarded by him as a sufficient reason for removing the gall-bladder. He emphasises, on the other hand, the necessity for early operation in order to get rid of stones before the cystic duct has been seriously damaged.

With ordinary X-ray plates and exposures gall-stones can be detected

Surgery of Gall-Bladder and Biliary Ducts

only in a small percentage of cases. Pure cholesterin stones give no shadow, and it is only when the stones contain a considerable proportion of lime salts that they become visible on the plate. Adhesions resulting from cholecystitis may supply indirect evidence such as deformity of the duodenal cap, pulling of the stomach to the right, or a high position and fixation of the hepatic flexure of the colon. Such evidence can only be regarded as confirmatory of the clinical signs and can rarely be of diagnostic value.

Barker⁵ has found it possible by special preparation and by the help of oblique lighting to demonstrate the presence of gall-stones in a larger percentage of cases than was formerly thought possible.

Braasch⁶ also states that with improved technique positive results can be obtained more frequently, and emphasises the importance of remembering such shadows in the differential diagnosis of other conditions in the right upper quadrant of the abdomen. While the character of the gall-stone shadow is often distinctive, error in interpretation is readily made. The greatest difficulty is in the differentiation between the shadow of a renal calculus and a gall-stone. The gall-stone may give a shadow in the area of the pelvis of the kidney, and if there is coincident infection of the urinary tract the diagnosis may be very difficult. On the other hand the kidney stone may not infrequently be seen lying over the 12th or even the 11th rib in the usual gall-bladder area. The shadow caused by the gall-stone and by the renal calculus may be identical in position and in shape. When the clinical symptoms do not definitely point to the diagnosis a pyelogram is usually the best, and frequently the only, method by which the gall-stone may be identified (Braasch). Recently the writer operated on a gall-stone case where the X-ray plate had shown a large shadow in the kidney region. The radiologist reported the case as one of renal calculus, but the clinical symptoms suggested either a gall-bladder lesion or a high appendix. At the operation a high retrocaecal appendix, inflamed and with a few drops of pus, was found, and in addition there was an acute hydrops of the gall-bladder associated with a large solitary gall-stone which had given the misleading shadow on the X-ray plate. The gall-bladder in this case was unusually long and lower in position than normal, owing to downward displacement of the liver, and was readily accessible through a high gridiron incision.

Examination of the Bile by means of the Duodenal Tube.

—Experiments by Meltzer⁷ suggested to Lyon⁸ the possibility of directly draining the biliary apparatus by means of the duodenal tube for diagnosis and treatment. Meltzer found that when he douched the duodenum with a solution of magnesium sulphate he could cause complete relaxation of the duodenal wall, and that this effect was not

James M. Graham

produced when the salt was swallowed in the usual way. He suggested, therefore, that it would be worth while testing the application of magnesium sulphate by means of the duodenal tube in cases of jaundice. It seemed to him possible that relaxation of the sphincter of the common duct might result, permitting the flow of bile in cases of catarrhal jaundice, or even the passage of a gall-stone impacted in the ampulla.

Lyon began clinical experiments on the lines suggested in 1917, and has subsequently made numerous observations on a series of 121 cases, introducing various solutions into the duodenum and withdrawing the bile for chemical, microscopical, and bacteriological examination.

When the tube is passed through the pylorus, during the period of fasting in a normal person, the sphincter of the bile-duct should be closed and the duodenum free from bile. Within a few minutes, however, after irrigating the duodenal mucosa with a solution of magnesium sulphate, it is possible by gravity, drainage, or simple suction to recover bile, indicating that the sphincter of the common duct has relaxed and that bile is forced into the duodenum.

Lyon has further pointed out that in normal cases three kinds of bile can be withdrawn in succession, the different characters of the bile suggesting that it is derived in the first place by emptying of the common duct, secondly from the gall-bladder, and finally from direct liver secretion.

Crile⁹ has investigated thirty cases and describes the following technique. The patient is given a duodenal tube to swallow and the contents are aspirated. The patient is then turned on the right side with the hips raised, and is instructed to massage the epigastric region from left to right. When it is ascertained that the tube has entered the duodenum—usually in from forty-five to sixty minutes—60 c.c. of a 25 per cent. solution of magnesium sulphate are injected into the duodenum. The tube is then clamped for three or four minutes. On removing the clamp a flow of fluid is expected, usually without aspiration. A small quantity of the sulphate solution returns first, but is followed by 5 to 10 c.c. of bile of a light golden colour and of the consistence of syrup, which represents the bile from the common duct. After a small quantity of bile with the above characteristics is withdrawn there is an abrupt change to bile of the second type, to be regarded as derived from the gall-bladder. During this phase the bile is of a thicker, more ropy, consistence, and of a dark colour; the amount obtained may vary from 25 to 100 c.c. Finally, the bile becomes of a lighter straw colour and more fluid consistency, indicating the third and last phase, during which the flow is liable to be intermittent. The amount collected in the last phase depends on when

Surgery of Gall-Bladder and Biliary Ducts

the sphincter contracts, and varies from a small quantity to as much as several ounces. When flowing spontaneously the bile emerges in a series of drops which ebb and flow like the discharge from the ureter. That the bile in the first and third phases comes mainly from the common duct and liver respectively, seems fairly obvious. The reasons stated by Lyon for concluding that the second type of bile comes mainly from the gall-bladder may be summarised as follows:—

- (1) That the action of the magnesium sulphate is reflex, causing relaxation of the sphincter in the papilla and contraction of the gall-bladder.
- (2) The colour and viscosity of the second bile indicate concentration. In cases of cholecystitis pus cells and muco-pus are in greater concentration in this bile. Frequently relatively large numbers or, occasionally, masses of bile-stained columnar epithelium are present, suggesting contact with concentrated bile for some time. In gall-stone cases bile crystals or sand may be present.
- (3) The amount of dark bile, nearly 6 oz. in some cases, indicates that the bile has been stored and therefore presumably in the gall-bladder, which is obviously dilated, if as much as several ounces are obtained.
- (4) The final reason for believing that the bile coming from the gall-bladder can be differentiated is based on the negative results obtained in patients from whom the gall-bladder has previously been removed.

In a series of ten cases on whom cholecystectomy had been performed, the second type of dark bile was never obtained.

The interpretation of the sources of the different types of bile is confirmed by Crile, who reports favourably on the magnesium sulphate reflex as an aid to diagnosis. In eight cases he was able to make the diagnosis of occlusion of the cystic duct previous to operation, and the diagnosis in each case was confirmed.

Lyon believes that with the duodenal tube and injection of magnesium sulphate it will be possible to recognise early cases of biliary stasis or of early infections of the biliary passages. In such cases four or more ounces of thick bile of the gall-bladder type may be withdrawn, and the method, if repeated, suggests a means of treating biliary stasis and possibly of minimising the risks of persistent infections or of subsequent gall-stone formation. In cases of catarrhal jaundice, Lyon states that he has been able to curtail the duration of the disease by over 50 per cent., as compared with a group of similar cases treated in the ordinary way. It is obvious that work on these lines requires to be investigated further before its practical value can be estimated.

James M. Graham

Jaundice and its Surgical Significance.—Mayo¹⁰ discusses the etiology of jaundice, basing his figures on the collected cases of the Mayo clinic. In approximately 50 per cent. of cases jaundice is due to obstruction of the common duct by gall-stones. In 20 per cent. of cases it is due to absorption of bile in the liver, or to infective or catarrhal jaundice. Most of the latter cases occur in children and young people. In 5 to 8 per cent. of cases jaundice is due to serious infection of the gall-bladder with or without stones; in such cases there is usually a degree of pancreatitis and marked swelling of the lymph glands on the main ducts.

Jaundice from cancer represents 15 per cent. of the cases; one-half of the cases in this group are cases of cancer of the liver, the remaining half are cases of cancer of the pancreas, gall-bladder, or ducts. In 8 per cent. jaundice is associated with cirrhosis and ascites.

The statistics from the Mayo clinic amply support the correctness of Courvoisier's Law. The gall-bladder was shrunken or atrophied in 84 per cent. of the cases of stone in the common duct. In 92 per cent. of cases of jaundice due to lesions in the ampulla or pancreas the gall-bladder was dilated. In cases of chronic jaundice with obstruction the gall-bladder and ducts are often filled with a clear mucoid fluid indicating, according to Mayo, that the power of the mucous gland to secrete the less absorbable mucus is greater than the power of the liver to secrete bile.

In cases of late operation, at which the so-called white bile is found, the prognosis must be regarded as unfavourable if the secretion of bile does not recover within a day or two following drainage.

Long-continued jaundice slows the coagulation time of blood. If the coagulation time is less than ten minutes it is not as a rule of serious moment; but a ten to twenty-five minutes' period is not uncommon, and in some cases the blood has been observed to be incoagulable for an hour. The value of calcium in these cases in reducing the coagulation time is doubtful. The best measure in cases of delayed coagulation time of twelve minutes or longer, is a transfusion of blood (Mayo). According to Crile the risk of hæmorrhage can be controlled by transfusion of blood which acts almost as a specific in cases of jaundice.

Exposure in Gall-Bladder Surgery.—Although there may be differences of opinion regarding the best incision, most surgeons are agreed that adequate exposure is essential for satisfactory work on the gall-bladder and common bile duct. When there is reason to believe that the operation is likely to be simple, a vertical incision through the right rectus, splitting the muscle, gives adequate exposure; but, when the common duct requires exposure or when a difficult cholecystectomy is anticipated, most surgeons now prefer the incision parallel with the costal margin and free division of the muscles. There

Surgery of Gall-Bladder and Biliary Ducts

is less risk of a subsequent hernia with this incision than when the rectus muscle is split to the extent necessary in a difficult case. With the oblique incision full advantage can be obtained from the use of a pillow, whereas the vertical incision, while making the liver more accessible, increases the tension of the abdominal muscles.

Masson¹¹ describes a procedure which is likely to facilitate exposure of the neck of the gall-bladder preliminary to cholecystectomy in difficult cases. After preliminary inspection of the abdomen, the stomach, colon, intestine, and omentum are displaced downwards by three or four packs held by the left hand of the assistant. It is important that once the packs have been placed the assistant's hand should be retained in position during the rest of the operation. In almost all cases satisfactory exposure is thus obtained, even when the liver cannot be rotated. In exceptional cases additional exposure is obtained by displacing the liver. A pack of gauze, four inches by three feet in length, is inserted between the postero-superior surface of the right lobe and the diaphragm. In this manner the liver can be made to descend slightly, the concave visceral surface is flattened and the hilum is made more accessible. The insertion of the pack is easy and harmless. One assistant retracts the costal margin upwards and outwards, while with a long shoehorn retractor the second assistant gently retracts the liver in the opposite direction. The gauze is now inserted along the shoehorn retractor by a pair of long forceps. The author states that this procedure has frequently made difficult cases of cholecystectomy absolutely safe.

When exposure of the cystic duct and artery is difficult the gall-bladder, if tense, should be first emptied. Curved artery forceps can then be applied, one pair to the fundus and a second pair to the ampulla. By traction on the forceps the cystic duct can be stretched, and as a rule readily isolated by blunt dissection. By obtaining adequate exposure and by attention to details of technique, Masson believes that it will seldom be necessary to strip the gall-bladder downwards in performing cholecystectomy.

Cholecystectomy: Indications and Results.—While there are many cases in which the patient suffering from gall-stones or infections would obviously be better without the gall-bladder, it must always be a matter of judgment to decide when to perform cholecystectomy, as, in difficult cases, the operation is bound to be more severe than simple drainage. In some clinics the operation of cholecystectomy is performed almost as a routine in cases of gall-bladder affections. According to Masson the cases are few in which the drainage operation is preferable, and he believes that there is little room for question that the right thing to do is to remove the gall-bladder when in doubt.

Crile believes, on the other hand, that the gall-bladder should not

James M. Graham

be unnecessarily removed. After it is removed the common ducts and extra hepatic ducts dilate and partly compensate for its absence. The abnormal storage of bile in the common duct may occasionally dispose to the formation of stone within the duct.

Symptoms referable to the gall-bladder are liable to recur in spite of drainage if the mucous membrane of the gall-bladder is gangrenous, if there is chronic infection of the gall-bladder, if there is a stone embedded in the cystic duct, if the wall of the cystic duct is thickened, or if the wall of the gall-bladder is thickened as a reaction to infection. In such conditions usually, but not always, recurrent obstruction and infection will occur and cholecystectomy is therefore to be preferred to cholecystostomy (Crile). In cases of acute empyema, when the function of the gall-bladder is likely to be permanently impaired, it is as a rule safer to perform simple drainage in the first instance and to remove the gall-bladder subsequently, when the acute symptoms and infection have subsided. In severe infections with degrees of gangrene, associated as a rule with impacted stone in the cystic duct, the gall-bladder should be removed, unless the serious condition of the patient makes haste imperative and drainage alone is justified.

Mayo describes the following method of performing cholecystectomy in such cases. The gall-bladder is split with scissors at each side a quarter of an inch from its attachment to the liver. A free flap is turned downward exposing the stone in the cystic duct and the duct is clamped in forceps and divided. The mucous membrane remaining attached to the liver readily peels off, leaving the outer layer of the gall-bladder for protection. This method of removal avoids the risk of hæmorrhage from the liver, which is difficult to control, and excludes also the danger of conveying infection to the liver which the introduction of sutures would entail.

The frequency with which the gall-bladder is excised in some clinics is shown by the statistics quoted by Charles Mayo. In a period of three years, 1916-18, cholecystectomy was performed in 2460 patients with a mortality of 1.8 per cent. There were 337 cases in which cholecystectomy and choledochotomy were both done with a mortality of 2.3 per cent. In a group of 36 cases of very severe obstruction and malignancy, cholecystectomy and choledochotomy were both done with a mortality of 16.6 per cent. In a similar group of cases choledochotomy alone was done with a mortality of 15 per cent. The mortality in a total series of 420 cases in which choledochotomy was done was 5.7 per cent., too high, according to Mayo, for simple cases of stone and obstruction, and too low a mortality for late and complicated cases, including the cancers. Stones were found in the common duct in 274 of the 420 cases.

Operative Injury of the Hepatic and Common Ducts.—In performing cholecystectomy there is considerable risk of hæmorrhage

Surgery of Gall-Bladder and Biliary Ducts

from the cystic artery, or of injury to the hepatic or common bile-ducts if the parts at the neck of the gall-bladder are not freely exposed. Many anomalies occur in the course and origin of the cystic artery, and in the mode of union of the cystic and hepatic ducts, and these facts explain many of the complications following operation.

Eisendrath¹² reports a series of 51 cases of injuries to the hepatic and common ducts, in most of which the damage was caused during the performance of cholecystectomy. If the injured duct is not successfully repaired at once a fistula is likely to result with copious leakage of bile, or else a stricture develops followed by jaundice.

The hepatic duct was accidentally ligated or divided in 19 cases, and the common duct in 16 cases. In 12 cases the junction of the cystic, hepatic, and common ducts had been resected; this accident apparently is encouraged by the angulation incident to traction on the gall-bladder during its excision. In 3 cases the hepatic or common duct was damaged in attempting to secure a retracted cystic artery. In one case the right hepatic duct emptied into the cystic duct and was included in the clamp.

In the majority of the cases (26 in number) the injury was recognised at the time and repair was successfully accomplished. In 4 cases one or more subsequent operations were necessary, while in 12 cases the injury was not suspected till subsequent symptoms indicated its occurrence. The mortality in the recorded cases (7.8 per cent.) is probably smaller than it should be, as unsuccessful cases are less frequently reported.

Circular suture of the divided ends is the ideal procedure, but may be difficult, and is only applicable as a rule in recent cases. Jacobson¹³ and others have recorded successful results in cases in which only a portion of the circumference of the divided duct could be accurately sutured. Some surgeons have found that suture of the cut ends was facilitated by the use of a rubber tube which can be brought to the surface for drainage through a separate incision lower down in the common duct. In a few cases the rubber tube has been brought through the ampulla of Vater into the duodenum, and Voelcker¹⁴ has further brought such a tube to the surface through a separate opening in the duodenum.

The presence of a stricture or of an extensive defect in the hepatic or common duct will usually call for some method of anastomosis. The gall-bladder is rarely available in such cases for cholecystenterostomy, as it has either been removed or is small and functionless. Reconstruction of a portion of the common duct over a rubber tube with the aid of omentum, and closure of defects by the use of a flap from the stomach wall, are methods which have been tried successfully in a few cases. In long-standing cases of stricture associated with jaundice

James M. Graham

and sometimes with fistula, the most feasible procedure to adopt is implantation of the proximal end of the duct into the duodenum.

Mayo records 13 cases, not mentioned by Eisendrath, in which the hepatic duct was anastomosed to the stomach or duodenum with the help of a rubber tube. Most of the cases had previously been operated upon on several occasions. The distended hepatic duct is searched for usually among dense adhesions. Its position is often indicated by a fistulous track. The end of the duct is often found opposite the pylorus or duodenum, but it may be situated close to the pre-pyloric portion of the stomach. Anastomosis is made preferably to the duodenum, but, if the duct is short and fixed by adhesions, the pre-pyloric portion of the stomach may be selected. Mayo has found that the operation is facilitated by using a portion of a bell-shaped rubber catheter, from $1\frac{1}{2}$ to $2\frac{1}{4}$ ins. in length. In cutting the tube most of the funnel-shaped end is removed, so that the calibre of the tube is left only slightly larger at one end than the other. Fixation of the catheter drain is insured by slipping two small rings from the next larger size of catheter over the tube where they are glued in place by rubber cement and fixed a short distance apart.

After loosening the duct for a short distance the end of the tube with the slightly larger diameter is inserted and fixed to the duct by a suture. An opening is next made into the stomach or duodenum, through which the lower end of the drain is passed. Before insertion of the tube the mucous surfaces of the duct and of the stomach or duodenum should be united by interrupted sutures; the sutured line being completed after introduction of the tube. Finally, the outer wall of the stomach or bowel is sutured around the end of the duct, and the anastomosis is wrapped round by omentum. The rings on the tube help to keep it in position; the upper one should lie just above the end of the duct and the lower one just within the stomach or duodenal wall. The tube may remain in place for several months, but in any case it will stay long enough to permit the mucous surfaces to unite. No distressing symptoms follow anastomosis between the bile-duct and the stomach.

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LETTER FROM VIENNA.

(From our own Correspondent.)

It may interest English readers to learn something about the present state of medical education in German Austria. After an eight-years' school curriculum, in which scientific subjects are too shortly dwelt on, the medical student enters the university in his eighteenth or nineteenth year. The medical course is divided into two sections. In the first, consisting of four semesters, the student devotes his time to the scientific subjects necessary for the understanding of disease. These comprise general biology, physics, chemistry, anatomy, histology, and physiology. This period of study is completed by the first professional examination, to which the student submits himself at the end of his fourth semester. He can, however, if he wishes, take the examination in physics, chemistry, and biology at the end of the second semester.

The second section of medical study extends over six semesters, during which the student attends the medical, surgical, obstetric, gynaecological, ophthalmological, dermatological, otological, pædiatric, and psychiatric clinics, has a course on vaccination, and attends instruction on pathological anatomy and histology, general and experimental pathology, pharmacology, and prescribing, hygiene and medical jurisprudence. After completing these studies the student takes his second professional examination in pathology, pharmacology, medicine, diseases of children, psychiatry, and neurology, and when this is successfully passed, he immediately appears for his third professional in surgery, midwifery, ophthalmology, skin diseases, syphilis, hygiene, and medical jurisprudence. Students who took part in the war are allowed to shorten their medical course by one-third, two semesters being, in their case, reckoned as three.

Having successfully passed his examinations, the student receives from the university his doctor's diploma, which in itself does not give the right to practise medicine. The graduate has to apply to the local authority in the place where he contemplates practising to be put on the register of medical men.

In the smaller universities the diligent student has more than ample opportunity during his curriculum of acquiring a good knowledge of his profession. In the University of Vienna this is not the case. Even were the clinics and institutes doubled or trebled, this would not be enough to afford the students the necessary instruction, especially in clinical work, on account of the lack of material available. Since the overcrowding of the medical classes in Vienna is not due to the presence of Austrian students, but to the influx of foreigners, especially from Eastern Europe, measures were in contemplation even

Letter from Vienna

before the war, whereby Austrians should have priority over foreigners, and the latter should only be admitted as students according to the number of vacancies. During the war, naturally, the university was almost deserted. Except for a few men physically unfit for service, the students were almost exclusively women, mostly Austrian and Russian Poles. With the end of the war there came an enormous rush of students, such as the Vienna Medical Faculty had never before had to deal with. As the influx of students was chiefly due to the number of natives of the Eastern States, rules were drawn up by the Senatus to prevent overcrowding of the medical classes. The Minister of Education at the time, however, was in no way interested in the problem of the home-born Austrian student, and would not sanction restrictive regulations. Since the change of government some form of protection for the Austrian student is expected, but at present the fact has to be faced that every year there graduate from the University of Vienna a larger number of doctors than a small state like German Austria can support, and this applies especially to the city of Vienna itself, in which, with a population of less than 2,000,000, about 4000 doctors are registered.

As a result of the educational conditions described, the young graduate as a rule finds it necessary to supplement his practical knowledge by attaching himself as assistant to a clinic, where he works for a longer or shorter time, at first for no payment, later for a small salary. The great majority of the recently qualified doctors begin practice in the country or in a town, taking either paid posts or settling down to private practice. A smaller number go in for official posts, for which a course of study and examination in Public Health is demanded. Only a very small number are fortunate enough to remain attached to hospitals and to obtain posts as assistants in clinics or departments (*Abtheilungen*). It must be explained that the clinics primarily subserve medical education, whereas in "departments" (which are mostly in the outlying hospitals) teaching is subsidiary. The clinics are under the educational authorities; the "departments" under the government (*Landesregierung*). The assistant, in any case, has ample opportunity for original work, and publishing his observations. Should he resolve to embark on a purely academic career, his next step is to apply to the university (Vienna, Graz, or Innsbrück) to bestow on him, on account of his scientific education and work, the *venis legendi* for his speciality. The candidate must then in argument and in a test lecture show his capacity for teaching, and if he succeeds he becomes a privat-docent in his special subject. As such, he has the right to lecture in the university, but has no access to clinical material. Unless, therefore, he is already the head of a hospital department he has to attach himself to a clinic or other hospital in

Letter from Vienna

order to obtain clinical resources; this, however, is not usually difficult, as he has been attached to one during his earlier training. Later, it may be only after many years, the privat-docent is given the title of extraordinary professor. A privat-docent receives no salary. In addition there exist a number of extraordinary professors, who not only enjoy the title, but are salaried, and act as directors of departments or institutes. It is only in the event of an extraordinary professor being at the head of a clinic that he is subject to the Minister of Education; the departments (*Abtheilungen*) are, as already stated, not under the educational authorities. The highest grade of the academic hierarchy is that of ordinary professor. The professor is the official representative of his speciality, and the chief of the corresponding clinique or institute. He has to lecture and to conduct examinations, and is responsible for the whole of his department. Under him are assistants, the seniors being usually extraordinary professors or privat-docenten. These conduct classes for graduates and students, direct the work of the different branches of the clinic, and act as the professor's substitute as occasion demands. Under them are intern and extern medical officers, on whom the general duties of resident physicians devolve. The externs and interns are badly paid, but since the war their condition in this respect has been improved inasmuch as they now receive board, either free or at a reduced rate. The salaries of the professors and assistants have been raised since the war, but by no means proportionately to the present fall in the value of money. While the chief of a clinic is allowed to practise privately, the subordinate members of the staff of the clinic can only do so if he permits.

In the non-teaching hospitals the arrangement in general is that at the head of a department is a director (*Primarius*) with two assistants, and one or more salaried house physicians (*Secundarii*). There are also usually one or two unpaid voluntary workers. The conditions of service, however, vary a good deal in the different non-teaching hospitals, according to local circumstances.

The nursing in a few of the hospitals is still done by the old-fashioned, almost untrained, attendants (*Wärterinnen*); in the majority, however, the patients are cared for by certificated trained nursing sisters, either religious or secular. There is also in Vienna a training school for midwives, organised on the lines of a clinic.

Long before the war it had been resolved to rebuild the old *allgemeine Krankenhaus*, yet so far only two gynæcological clinics, the children's clinic, a laryngological clinic, and a medical clinic have been completed in the large new hospital. There are also in Vienna eight State, one municipal, and a number of private hospitals. In the other towns of German Austria there are hospitals according

Letter from Vienna

to the needs of the locality, with clinics at Graz and Innsbrück. There are also, especially in Vienna, private ambulatoriums or out-patient dispensaries, some of which have a few beds—for example, the Poliklinik. The chiefs and assistants in these are for the most part extraordinary professors and privat-docenten, and teaching is carried on.

The former military hospitals have been put to various uses. Some have been handed over to the new national militia and their dependents; others have been converted into civil hospitals, and others are used for housing scientific collections, etc. The old officers' hospital has been turned into a sanatorium for middle-class patients, for which its central position renders it peculiarly suitable.

NEW BOOKS

Public Health and Hygiene. Edited by WILLIAM HALLOCK PARK, M.D. Pp. 859, with 123 illustrations. Philadelphia and New York: Lea & Febiger. 1920.

Twenty-four different authorities have contributed chapters to this new American text-book on Hygiene. The standard set is high and its excellence is generally well maintained; but the diversity of authors has led to inequalities of treatment. The sections dealing with Infectious Diseases are particularly well written. The detailed description of the Schick test in Diphtheria and the importance attached to it in America is of special interest. On turning to the chapter that deals with Disinfection one is not so satisfied—no allusion being made to the use of the spray for disinfection; gaseous disinfectants being still advised. This is contrary to the teaching in our country. Another excellent contribution deals with Air, Health, and Ventilation, and Dr Park discusses in a very lucid and thorough way the question of pure milk supplies. We have much to learn from America in this direction. Other instructive sections deal with the much discussed vitamins, with sociology, and with mental hygiene. Military and maritime hygiene also find places. The text-book is a valuable addition to the literature bearing upon preventive medicine.

Surgical Therapeutics and Operative Technique. By E. DOYEN, with the collaboration of H. SPENCER BROWNE. Vol. III., pp. ix + 811, with 959 illustrations. London: Baillière, Tindall & Cox. 1920. Price 45s. net.

After unavoidable delay, due to the sudden death of M. Doyen and the occupation of his collaborator with military duties, the third volume of this valuable work has at length appeared. It is devoted to abdominal and gynæcological operations, and is on the same high plane as its predecessors. Dr Spencer Browne has placed English readers under a debt of gratitude by placing at their disposal, in a complete form, the work of a surgeon of such outstanding originality as M. Doyen, and is to be congratulated on the success of his translation.

The Principles of Preventive Medicine. By R. TANNER HEWLETT, M.D., F.R.C.P., D.P.H., and A. T. NANKIVELL, M.D.(Lond.), D.P.H.(Camb.). Pp. 527, with 17 illustrations. London: J. & A. Churchill, 7 Great Marlborough Street. Price 21s. net.

The volume concerns the medical practitioner and medical student. It is not sufficiently informative for those intending to specialise in public health. The authors do not, however, advance such a claim.

New Books

But the book can be recommended. The style of writing is breezy, some may think it flippant; but it is always interesting. The information vouchsafed is up-to-date. For instance, the section dealing with Venereal Diseases is very good. One cannot see eye to eye with the advice to have every case of Scarlet Fever removed to hospital because "the doctor's other patients will not care for him to be attending 'a case of the fever.'" The people are better educated than that nowadays. The publishers have done their work well.

Scurvy, Past and Present. By A. F. HESS, M.D. Pp. 279, with 25 illustrations. Philadelphia: Lippincott. 1920. Price 18s. net.

This small monograph gives, in the first place, a good historical review of the disastrous effects that scurvy has had in expeditions and voyages of the past, and does full justice to the important work that was done by Lind, during the later half of the eighteenth century, in pressing upon the British Admiralty the dietetic measures necessary for its prevention and cure. As regards its present-day manifestations, the author naturally deals almost entirely with the important effects produced by the disease in badly-fed children, and he gives several excellent radiograms and microphotographs showing its results. He deals with the subject of treatment from the most modern view, which regards scurvy as a disease due to deficiency of vitamins in the food, and the book gives an outline of the most important experimental work that has been done on these lines in recent years. Curiously, however, he does not mention the value of soured milk in this connection. The book is a valuable résumé of the subject of infantile scurvy which will be useful to those who take a special interest in children's diseases.

Surgery: A Text-Book by Various Authors. Edited by GEORGE E. GASK and HAROLD W. WILSON. Pp. xix+1232, with 506 illustrations. London: J. & A. Churchill. 1920. Price 42s.

This text-book may be taken as an authoritative reflection of the surgical teaching of the important medical school at St Bartholomew's Hospital. All the articles are contributed by members of the staff of the hospital, and the editors have been successful in securing the co-operation of representatives of every branch of surgery. Overlapping and repetition have been skilfully avoided and a due sense of proportion has been maintained. Space forbids that we should analyse such an exhaustive treatise in detail, and to select particular articles would be invidious. Suffice it to say that we have examined the work critically and can recommend it as a satisfactory and reliable presentation of surgery for students. It is clearly printed and well illustrated.

NEW EDITIONS

WHITE AND MARTIN'S *Genito-Urinary Surgery and Venereal Diseases*. Twelfth Edition revised. By MARTIN, THOMAS, and MOORHEAD. Pp. xiii. + 928, with 424 illustrations. Philadelphia and London: J. B. Lippincott Company. 1920. Price 35s. net.

The first edition of this book was published in 1897, and now in 1920 we have the twelfth edition before the public. This is in itself a proof that the book has fulfilled a purpose and that it has established its place among recognised text-books. This latest edition has been revised, and a new chapter added on the prophylaxis of venereal disease.

The authors, while avoiding going into theories, have discussed the established facts.

Treatment is discussed freely and fully, and the latest advances in diagnosis and treatment are considered. The treatment of venereal disease is full and concise, and the indications freely discussed. Syphilis occupies two hundred odd pages and includes diagnosis, the Wassermann reaction and treatment. Gonorrhœa is treated at length, and its complications.

The surgery of the genito-urinary tract is dealt with in an efficient manner, and the latest form of treatment such as the use of radium and high frequency in papilloma of the bladder mentioned.

The paper and print are good, the illustrations numerous and well executed. There are, however, one or two in which the lettering in the picture has been missed out.

The book will prove a useful addition to the library of the general practitioner, and to the specialist in this line of work.

The Anatomy of the Human Skeleton. By J. ERNEST FRAZER, F.R.C.S.(Eng.). Second Edition. Pp. 284, with 219 illustrations. London: J. & A. Churchill. 1920. Price 36s. net.

This work, although only in its second edition, has already attained the position of being widely recognised as the best book on the subject in the English language. It differs from most other works on the skeleton in not being limited merely to a description of dried specimens, but in being devoted especially to giving a full account of the relationships between the bones and the overlying soft parts. We are given, accordingly, a description not only of the conformation of the bones, but of the constituents of the adjacent joints, the muscles, vessels, and nerves in their relationship to the various elements of the skeleton.

New Editions

The accounts of the structures attached to the bones are most elaborate, almost excessively so, a full description being given not only of muscles and ligaments but of every small aponeurotic expansion or layer of fascia connected with the bones. The book, therefore, implies a considerable knowledge of the anatomy of the soft parts for its proper appreciation, and is more suited to the needs of the senior than of the junior student.

The diagrams, which are apparently the work of the author, are most complete and helpful, and are exactly suited to this type of textbook. The volume can be warmly recommended to the advanced student of anatomy.

Feeble-mindedness in Children of School Age. By C. PAGET LAPAGE.
Second Edition. Pp. 309. Longmans, Green & Co. 1920.
Price 10s. 6d. net.

The second edition of Dr Lapage's book has been long overdue. The passing of the Mental Deficiency Act and the effects of its partial operation have rendered necessary the inclusion of much new material. Dr Lapage points out many of the defects and difficulties which have been brought to light in the operation of the Act, and suggests various amendments which are desirable. He might have strengthened his case by referring to the corresponding Scottish Act. We have our troubles in Scotland, but are happily free from some of the irritating and needless difficulties which afflict our brethren south of the border. We should have liked a more adequate discussion of moral imbecility, and Dr Goddard's views on the nature of feeble-mindedness are of sufficient importance to deserve discussion. On the subject of "tests," the book is decidedly weak. Taken as a whole, however, Dr Lapage's book is one of the best of the smaller works on its subject, and may be specially recommended to teachers, nurses, and other workers in schools and institutions for the feeble-minded, who will find much reliable information in the body of the book, and numerous practical hints in the admirable appendix on the training and management of feeble-minded children by Miss Mary Dendy, M.A., now one of the Commissioners of the General Board of Control.

NOTES ON BOOKS

Professor Cushny's *Text-Book of Pharmacology and Therapeutics* (J. & A. Churchill, price 18s. net) is so well established that it is scarcely necessary for us to do more than record the appearance of a seventh edition. In this are embodied much of the experience acquired during the war with regard to the action of various antiseptic agents, and the use of drugs in different diseases. The less important drugs are gradually being eliminated from this work, and the author is so discriminating and judicial in his estimate of those dealt with that his text always carries conviction to the reader.

The eighth edition of *Modern Surgery*, by John C. Da Costa (W. B. Saunders Company, price 37s. 6d. net), revised and considerably enlarged, maintains the high standard of previous editions. Gunshot wounds and their treatment are discussed in the light of experience gained in the war, but, as the author points out in his preface, "the war has developed an immense amount of literature which has not yet been sorted, analysed, and weighed with accuracy." In addition to General Surgery and operative procedures, chapters are devoted to Anæsthetics, Bandages, Plastic Surgery, and X-Rays, Radium, and Radiotherapy.

In the latter section, rewritten by Dr Pfahler, the various methods for the localisation of foreign bodies are given and the treatment of malignant disease by X-rays, radium, and electro-coagulation is also discussed.

The illustrations throughout the text vary considerably. Many are excellent, but others of them are hardly worthy of such an otherwise excellent volume.

The Early History of Surgery in Great Britain, by G. Parker, M.D., M.R.C.S. (A. & C. Black, Ltd., price 7s. 6d. net), belongs to the series of Medical History Manuals. It traces the advances in Surgery from the period 1000-1300 A.D., when Theodoric laid down that "it was not necessary that pus should be generated in wounds" up to the nineteenth century, when so many scientific discoveries made possible the great advances of modern times. The volume is a welcome addition to this series.

In the new edition of Dr Charles Porter's *School Hygiene and the Laws of Health* (Longmans, Green & Co., 1920, price 6s. 6d. net), several chapters have been extended and new chapters added. The necessary minimum of anatomy and physiology is so set out that the laws of hygiene become deducible and easily understood. The book has been brought up-to-date and its value further enhanced.

Books Received

Miss M. A. Gullan's *Theory and Practice of Nursing* (Lewis & Co., 1920, price 10s. 6d. net) is a summary of the instruction given to nurses training at St Thomas's Hospital. It appears to us wholly excellent, and covers the subject of nursing fully, without encroaching on the domain of medicine. A chapter on the nursing of sick children might have been added with advantage.

In *Electrotherapy* (J. & A. Churchill, 1920, 5s. net), Dr Curtis Webb gives a synopsis of the applications of electricity, X-rays, and radium in disease. It is concisely written and is not marred by undue optimism as to results.

The radiologist who is concerned with the construction of the apparatus he uses will find Mr M. A. Codd's *Induction Coil Design* (E. & F. N. Spon, 1920, price 21s. net) of interest. It is written from the standpoint of a practical electrical engineer, and is a technical treatise not overburdened with mathematical theory.

Though the food requirement of the people is now a matter of less urgent interest than in 1917 and 1918, the physiological studies on the *Feeding of the Nations*, by Professor Starling (Longmans, Green & Co., 1919, 5s. net), of which he gave the substance in the Oliver Sharpey Lectures, helped towards victory, and are in themselves well worthy of preservation in this permanent form.

BOOKS RECEIVED

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|---|------------------------------------|
| ANDERS, JAMES M., assisted by JOHN H. MUSSER, Jr. A Text-Book of the Practice of Medicine. Fourteenth Edition | (W. B. Saunders Company) 45s. |
| BOYD, MARK F. Practical Preventive Medicine | (W. B. Saunders Company) 20s. |
| HOLLINGWORTH, H. L. The Psychology of Functional Neuroses | (D. Appleton & Co.) 10s. 6d. |
| MANSON - BAHR, PHILIP H. Manson's Tropical Diseases. Seventh Edition | (Cassell & Co., Ltd.) 31s. 6d. |
| PRICE-JONES, CECIL. Blood Pictures. Second Edition | (John Wright & Sons, Ltd.) 6s. 6d. |
| RIDEAL, SAMUEL, and J. T. AINSLIE WALKER. Approved Technique of the Rideal-Walker Test | (H. K. Lewis & Co., Ltd.) 1s. |
| ROCKEFELLER FOUNDATION. Annual Report. 1919 | (The Rockefeller Foundation) |
| THOMSON, JOHN. The Clinical Study and Treatment of Sick Children. Third Edition | (Oliver & Boyd) 32s. 6d. |
| WELLS, H. GIDEON. Chemical Pathology. Fourth Edition. | (W. B. Saunders Company) 35s. |

Edinburgh Medical Journal

May 1921

TREATMENT BY X-RAY AND RADIUM.

*With Special Reference to the Value of these Agents.**

By ROBERT KNOX, M.D.

THE correct appreciation of the value of a remedial agent is always difficult. This is particularly the case in internal medication where the action of, for example, a drug is in question, and it is often only possible to arrive at the true value after numerous experiments and the lapse it may be of years.

When an agent which appears to act upon all structures with which it comes into contact is employed, the difficulties increase proportionately with its effects upon their structures, and the greatest care must be exercised in all attempts to estimate its value. The radio-active bodies are agents of this class, and it is very difficult even approximately to estimate their value. The range of therapeutic activity of radiations is an exceedingly wide one, extending from the very low ultra-violet to the penetrating Gamma ray of radium. The fundamental principle of radiation therapeutics is easily understood, if it is realised that the wave-length of the radiation is the determining factor. When the correct wave-length for a particular depth has been estimated, it is then merely a matter of time, *i.e.*, duration of the exposure, to produce a particular effect upon the tissues. The effect of the radiation is dependent upon the power of absorption the tissues possess for these particular wave-lengths, and the absorption of the radiations causes changes in the cells, which may vary in their degree; chemical changes may result which have a far-reaching effect upon the organism. In order to obtain effects over a wide range of morbid processes, it is necessary to have at our disposal radiations of all wave-lengths so that any condition

* Communicated to the Medico-Chirurgical Society of Edinburgh,
2nd February 1921.

Robert Knox

may be treated. In X-rays and radium rays we possess the particular values required. Large quantities of radium may be used with advantage, as, for example, at the Middlesex Hospital, where $5\frac{1}{2}$ grammes have been used for varying times in the treatment of malignant disease. Many valuable observations have been made on the effects of such large doses of the Gamma rays.

The physical data in radiation therapeutics are readily arrived at. The great difficulty is that we have so far not been able to gauge with accuracy the biological response to the radiations on the part of the tissues acted upon. That always has been, and will always be, the chief difficulty.

The estimation of the value of radiations in the treatment of disease is consequently very difficult, and calls for much accuracy and impartiality on the part of the observer.

RELATIVE VALUE OF X-RAYS AND RADIUM.

A great deal of unnecessary discussion has taken place on the relative values of X-rays and radium rays, the assumption being that these agents act differently upon the tissues. The matter will be more clearly understood if we assume that we are dealing with radiations which have a very wide range of wave-length, the Gamma ray from radium representing the extreme limit of penetrative power. Given an equal wave-length from either agent the effect will be the same. The X-ray value has been up to the present limited by the inability of the apparatus to generate the high voltage necessary to produce from the X-ray tube a short wave-length which will equal that of the very penetrating Gamma ray. So far it has only been possible to use voltages of from 200,000 to 250,000; the voltage required to produce X-rays equal to the Gamma ray is approximately between one and two millions. Nevertheless, the voltages of 250,000 give us a very useful radiation, which, if applied in sufficient intensity, may give very good therapeutic results. For example, cancer of the cervix uteri may be influenced by massive doses of X-rays administered through several ports of entry. The dose may have to be very prolonged, from five to eight hours at a single treatment. Good effects are claimed for this particular technique. Radium is more applicable in these cases, because it can be applied directly to the growth and gives in this very brilliant results; these are, however,

Treatment by X-Ray and Radium

purely local, and are not permanent. The use of both agents would appear to be a rational procedure. By this method of attack it is possible to obtain the maximum effect from both agents, the radium acting from a local focus and spreading outwards to the periphery, while the X-rays are used from the periphery to a central focus point. The tissues are thoroughly saturated and simultaneously attacked from all points. It is possible that in this way peripheral extension of the new growth may be checked.

The available range of wave-length in radiation treatment starts with the very low penetrative value of the ultra-violet radiation to the extremely penetrating radiations from radium: the Gamma ray representing so far as we know at present the extreme limit of penetration. The limitation of action depending upon the power to penetrate the tissues is the key to the explanation of the effects produced, and it may be taken for granted that radiations of any wave-length will act upon living tissues, provided they are brought into contact with them for a sufficiently long time. Ultra-violet radiation will cause a violent superficial reaction upon the skin. X-rays of long wave-length will give an equally violent reaction if the dose is sufficient, while it is also possible, by a long exposure to the Gamma radiation from radium, to produce a vigorous superficial reaction. When deeper effects are required, it is necessary to resort to the more penetrating radiations, the less penetrating having very little effect beyond a centimetre or so of tissue.

It is a common experience to find that in superficial lesions of the skin, ultra-violet, X-rays, and radium rays can all be employed with success.

In X-rays and radium we undoubtedly possess agents whose potency is very great, and whose effects have been so varied in regard to the tissues acted upon, and the pathological conditions influenced, that we at once ask what this action is, and what is its exact value in practical therapeutics. Never in the history of medicine have we been able to record such a wide range of activity. Indeed, the correct appreciation of the action of radiations upon living tissues may eventually revolutionise all our preconceived ideas regarding metabolic processes, and lead to very drastic changes in therapeutic methods. That, however, is a matter for the future.

It is impossible to deal in detail with all the diseases which may be treated by radiations. For the purpose of this

Robert Knox

paper it will be sufficient to group the diseases and discuss the value of the treatment in relation to particular diseases in each group.

Superficial Lesions are the most favourable for treatment, in so far as they can be kept continually under observation and progress noted; occasionally, it is possible to remove a piece of tissue for examination, when changes in tissue due to the treatment may be noted, and the exact character of the condition ascertained. The study of the changes induced in superficial structures gives an accurate indication of the type of case likely to respond to treatment, and also illustrates clearly the probability of influencing deeper morbid conditions; for it will be seen that the simple conditions, such as chronic inflammatory lesions, simple ulcers, *nævus*, etc., can be beneficially treated with a remarkable accuracy, while those conditions which verge on the malignant, *i.e.*, rodent ulcer and epithelioma, are more intractable, the very malignant forms of carcinoma frequently resisting treatment altogether.

Exactly the same sequence is noted in the so-called deep therapy. The effects are, however, much more difficult to obtain on account of the greater difficulty in administering the correct dosage; more penetrating radiations are required in order to reach the depth of the lesion, while the intervening tissues absorb in a diminishing ratio, according to their depth from the surface, the radiations which have to pass through them to reach the tumour.

When these difficulties are allowed for it will be seen that the order of response is almost identical with that of the more superficial lesions.

For practical purposes it will suffice if the subject is dealt with particularly in regard to known therapeutic effects and results in particular regions of the body and in special diseases which have been treated in large numbers of patients. In this way it should be possible to provide subject for discussion, and eventually to arrive at a fairly accurate estimation of value.

Fortunately, for our purpose, a sufficient length of time has elapsed since radiations came into general use to enable us to consider a very large number of cases of a large variety of disease; these will be dealt with in order, and as far as possible broad conclusions indicated.

The earliest cases treated were all superficial lesions of the

Treatment by X-Ray and Radium

skin. I understand that it will be helpful if these are discussed at considerable length; though in the presence of dermatologists I hesitate to be too dogmatic either in regard to results or in the details of technique. Of superficial lesions **Tinea of the scalp** has been the disease most frequently treated. I would therefore state at once that the X-ray treatment of ringworm in competent hands is probably the most successful of the many methods used for the treatment of this very troublesome disease. It is rapid in its action, fairly successful, and probably the most expeditious, but I would suggest that in view of the danger of the application other and safer methods should be given a trial. I know that my view will not meet with the approval of dermatologists, but I feel that if, in the early stages, treatment by ointments and disinfectants is efficiently carried out success should follow. Radiation treatment has its dangers, and if a disaster occurs it is likely to be permanent. That the danger is a real one I can confidently assert. I have seen very disastrous results follow upon X-ray treatment of ringworm in most competent hands. A word of warning in regard to technique is necessary. The individual prescribing the treatment should be familiar with the technique, and should be directly responsible for its execution. I know of a series of over-dosage in which a dermatologist instructed the X-ray department at a hospital to administer full pastille doses to a number of children suffering from ringworm of the scalp. For years the treatment had been successfully carried on under the care of an experienced radiologist, the practice of later years having been to employ a filter of $\frac{1}{2}$ mm. of aluminium. Just under a full pastille dose was sufficient to produce the depilation when a moderately hard tube was used. Many hundreds of cases had been in those years successfully treated, and no case of permanent alopecia had occurred. The dermatologist insisted on the filter being withdrawn, and he prescribed a pastille dose to each area of the scalp according to Adamson's formula. In a very short time seven cases of almost complete alopecia occurred. One might say at once that the cases had been overdosed, but it is well to point out that in the above method of estimation an error of at least twenty per cent. may be made by individual observers. The use of a filter minimises the risk.

The person prescribing the dose is responsible, and it is his duty to see that it is correctly given.

Rodent Ulcers.—A large number of rodent ulcers have

Robert Knox

been kept under observation for a number of years. Several successful cases are still well, but the majority even of the successful ones relapse from time to time and ultimately resist treatment. Several have been kept under observation to the very end; the final result of treatment of a rodent ulcer of the face is by no means a pleasing one—and a consideration of the history of a large number of cases leads to the conclusion that we are a long way from the attainment of absolute success.

In comparing radiation treatment with surgical operations for the removal of the growth it is well to remember that surgery also has its failures.

It is possible that greater success will be met with in radiation therapy when we arrive at a more accurate estimation of the required dosage. The cases treated by radium are on the whole more successful than those by X-rays, though on occasion it is well to combine the radiations and even to supplement them by the ultra-violet rays.

The earlier cases treated gave satisfactory results, though a number were very troublesome, particularly at the edges of the ulcer. Even when the edges healed completely relapses occurred. These yielded to further treatment, but eventually the condition got out of control, and rapidly progressed in spite of all forms of treatment. A large number of cases showed recrudescence as the years progressed. In the later cases treated by X-rays, and particularly in those treated by radium, the progress has been more satisfactory; the tendency to relapse has been lessened. Possibly this has been due to a more thorough technique. A number of the cases I show you come under this category.

Lupus Vulgaris.—It has been said by dermatologists that X-rays should not be used for the treatment of lupus. This, in my opinion, requires qualification. I have had a fair amount of success in the treatment of lupus vulgaris by combined treatment, consisting of regular exposure to ultra-violet radiations and X-rays and radium rays.

I have not seen epithelioma develop in these cases as a result of X-ray treatment, though it must be admitted that it has occurred. A well-known dermatologist recently said that prior to the use of X-rays epithelioma was rarely or never seen to supervene upon a lupoid condition. Since X-rays have been employed it is not uncommonly met with—possibly as a result of over or indiscriminate dosage.

A skin surface which is already damaged by the ravages of

Treatment by X-Ray and Radium

lupus requires to be very carefully treated when radiations are used, because the cellular structures are more vulnerable and might be stimulated to irregular overgrowth.

I believe the ultra-violet radiation is most useful in the treatment of this condition, and X-rays should only be used occasionally, in well-measured doses, care being taken not to over-stimulate the tissues at any time. If due care is exercised I believe very good therapeutic effects ensue.

There are many other conditions of the skin, unnecessary to discuss here in detail, which respond to radiations. A notable example of the values of combined treatment is seen in the case of a patient who had suffered for years from a most disfiguring **acne** of the face. In the treatment of such a case the course employed is to be commended, a combined attack, in which drugs, vaccines and practically all wave-lengths of radiations were used, ending in a very successful result.

Hyperidrosis is another example of a troublesome condition which is readily controlled by radiations. Several doses of X-rays directed towards the affected region will usually produce the desired effect. The axilla is the region most frequently treated. Many cases have been dealt with successfully. The *sequelæ* to over radiation may be chronic dermatitis and later telangiectasis; but if care is exercised and the correct dose given no untoward result need be anticipated.

Morbid conditions of the Blood.—*The Leucæmias, Banti's Disease, etc.*—The blood and serum provide fruitful media for the study of radiation effects and values. The fluid constituents of the body are acted upon in all radiation therapeutics, and profound changes are induced which may directly or indirectly contribute to the final result. A general action, which might be referred to as the constitutional, in contradistinction to the strictly local, is noted in every case treated. This may be transient in the majority of cases, but its occurrence may be a very serious incident in the course of treatment of a deep-seated lesion where the action is pushed to the limit of safety.

Speaking broadly, the results obtained in the treatment of general blood conditions are disappointing. Often a very favourable response is obtained, and this may persist for many months, or even years, but the final result is unfavourable. The discussion of this most important subject would form a theme for a whole evening.

Robert Knox

From the remarkable effects produced by radiations in leukæmia, for example, in the earlier stages of treatment, it is permissible to argue that in the future an improved technique might help to maintain the effects and in time restore the balance in the blood constituents and so effect a cure. Very radical changes in technique might be admissible; for example, the whole body could be irradiated by very penetrating rays daily, or even continuously for days, provided the dose administered was proportionately attenuated. Treatment should be continued for long periods after the patient has apparently recovered.

Although up to the present the final result of treatment has been unfavourable, attention should be drawn to the fact that in a number of cases systematic radiation treatment has succeeded in restoring a considerable measure of health to the patients and enabled them to lead an active life for some months, in some cases years.

In this connection the following summary is interesting. Mr Mayo's remarks on splenectomy should be specially noted.

SUMMARY OF A CASE OF MYELOID LEUKÆMIA.

S. Clarke, 44; single.

Family History.—Very good; no case of leukæmia in family.

Preceding Illnesses.—Malaria two days in 1911, one day 1920.

Tonsillitis; chronic tooth sinus; diphtheria; catarrh of lungs; small hæmorrhages and pain in right kidney, 1915; hæmorrhages on coughing; defæcation; blowing nose; unaccountable bruising.

1918.—Continuous fever, 102°-103° for seventeen days; spleen slightly enlarged; lost two stone.

Dec. 1918.—Three weeks morning diarrhœa during voyage home.

April 1919.—Large spleen discovered reaching down into false pelvis 1½ in. across middle line; liver and heart enlarged; myeloid leukæmia diagnosed.

7th May 1919.—Leucocytes, 600,000; reds, 4,000,000.

13th May.—X-rays begun. Leucocytes, 200,000; reds, 3,200,000; Hb, 60 per cent.

30th May.—Leucocytes, 100,000; reds, 3,730,000; Hb, 76 per cent.

Splenectomy here advised.—Patient consulted Osler, who recommended continuing with X-ray treatment, and suggested he should write to Mayo *re* operation. Letter from Mayo enclosed.

Treatment by X-Ray and Radium

20th June.—Last dose 1st series X-rays.

3rd July.—Whites, 5000.

29th „ — „ 3200.

Blood Counts—

	Whites.	Reds.	Hb.	
18th Aug. . . .	4,800	6,500,000	95	{ 1 Megaloblast seen.
15th Sept. . . .	5,200	5,700,000	95	{ ...
23rd Sept. . . .	6,400	4,900,000	95	{ No Megalo- blast seen.
13th Nov. . . .	7,000	...	100	{ ...
11th Dec. . . .	14,000	5,300,000	...	{ ...

1st Jan. 1920.—Osler and former teacher advised patient to continue X-rays. Bones as well as spleen to be irradiated. Osler pleased with progress and with smallness of spleen.

Present Symptoms.—(1) Slight diarrhoea from intestinal fermentation; (2) slight cough; (3) change of temperament from sanguine to placid; (4) slight clonic contraction of muscles where exhausted.

Capacity for Work.—Can do half-day's work in epileptic colony, 330 patients, and take charge when superintendent is away. In 1920 only lost one day's work.

“We have removed a number of spleens for splenomyelogenous leukæmia. The large majority of these were first reduced with radium. We found that any form of treatment which would reduce the size of the spleen would correspondingly reduce the white blood count, and then the red cells would come up and the patient would be greatly improved. This improvement was always temporary, and after a little time radium lost its effect.

“Therefore it seemed advisable in selected cases to remove the spleen as soon as the patient had been got in good condition by this means.

“The last time I looked it up there had been twenty-three splenectomies for this condition with one death from operation. The patients who recovered from operation were all more or less improved, two so greatly as to lead to the supposition that they might not have had true leukæmia.

“There is running through the entire group of splenomegalies about 5 per cent. of cases that are difficult to classify, and therefore the results in this group cannot be safely taken as the truth.”

In this relationship it is interesting to read Sir Berkeley Moynihan's paper on the Surgery of the Spleen (*Lancet*, 22nd

Robert Knox

January 1921), in which he quotes W. J. Mayo's observations on Splenectomy in relation to Leukæmia, etc.

He also gives the observations of Ordway, who discusses the whole question of radium therapy very thoroughly, and draws the following conclusions:—

(1) Surface applications of radium in leukæmia produce striking, indeed remarkable, improvement in (a) the blood picture which becomes almost normal, (b) the size of the spleen and glands, which are reduced almost to normal, (c) the general condition of the patient, who from being emaciated and weak may become plump and strong.

(2) The duration of the remission is variable; it may last from months to years.

(3) The results of radium treatment are not regarded as curative. It is believed to be, however, the safest as well as the most prompt palliative measure in cases of leukæmia, whether refractory or not to benzol or X-ray treatment.

Radium therapy is therefore believed to be the best form of treatment at our disposal.

X-rays when applied correctly will give as good results as radium, so we may assume that in these two agents, either alone or combined, we can offer an alternative treatment which promises as good results as splenectomy.

W. J. Mayo recommends the use of radium as a preparatory step to the operative.

Many valuable observations could be made in a thorough investigation of this important subject. I believe that a very careful investigation of the action of radiations upon the blood may give us very important guides in treatment. The action upon the normal blood has already shown that it is imperative that workers in X-rays and radium should be most thoroughly protected if they are not to suffer from the disastrous effects of over-exposure. The work published by Dr Mottram on blood changes induced in the case of workers at the Radium Institute, London, is illuminating. I am convinced that if a systematic study of the changes in the blood effected by radiations in diseased conditions is made, we will find that it is possible to obtain indications for the control of dosage.

This field alone is worthy of the undivided attention of many research workers.

In diseases of the blood in which the spleen is enlarged, as in leukæmia and splenic anæmia, radiations claim first place

Treatment by X-Ray and Radium

with surgery in treatment, and it may be asserted with a fair degree of certainty that the results may be as good as those obtained when splenectomy is employed.

The spleen can be reduced in size, or even returned to the normal by carefully-judged radiation treatment. Doses given after the normal has been achieved at regular intervals may be helpful in keeping in check the ravages of the disease.

One case of Banti's disease seen over twelve years ago was practically cured by a twelve-months' treatment given at intervals of about a month, and after that time regular doses every two months or so. The patient died from a pulmonary attack ten years after the treatment. The spleen in this case reached to the brim of the pelvis and extended over the middle line to the right of the abdomen. It is interesting to record that the patient had doses three times a week for a month; at the end of that time no change could be detected, so splenectomy was seriously considered. The operation was decided against largely because another case in the hospital at that time was not doing at all well after splenectomy. Treatment was persisted in with the satisfactory result recorded.

Diseases of the Thyroid Gland—Exophthalmic Goitre.—Radiation treatment in this disease gives excellent results. Great care must be exercised in dosage if damage to the skin is to be avoided. Acute cases require combined treatment, particularly rest and drugs. Treatment should extend over long periods of time. Combined treatment offers a good alternative to the operative.

A large tumour of the thyroid was diagnosed as malignant, and on account of its size operation was decided against; as a last hope radium was tried. In several months the tumour had completely disappeared and the patient recovered, to resume her occupation. This case is not claimed as a malignant one cured by radium. In all probability it was a simple inflammatory condition which, so far as prognosis at the time was concerned, was exceedingly malignant in its action. The patient was alive and well six years after the treatment and has not reported since that time. Presumably she remains well.

The Lymphatic System.—The value of radiations in the treatment of the diseases of the lymphatic system is unquestioned. The response is so marked that I have ventured to suggest the use of a measured dose as a diagnostic test, basing

Robert Knox

the suggestion on the results observed in dealing with a large number of cases.

Taking this response of enlarged glands to radiation treatment, the following table may be constructed :—

- (1) *Inflammatory Enlarged Glands*.—Very rapid response.
- (2) *Lymphadenomatous Glands*.—Rapid response.
- (3) *Sarcomatous Glands*.—Rapid response, sometimes almost as rapid a diminution in size as in the case of simple inflammatory glands, but the effect is rarely permanent; there is a tendency to recurrence, and an ultimate refusal to respond to further treatment.
- (4) *Tuberculous Glands*.—Slow response. As a rule, they slowly subside and become quiescent, but very rarely entirely disappear; they tend to become active again after longer or shorter intervals. From the point of view of treatment it is well to remove the glands after they have become quiescent.
- (5) *Carcinomatous Glands*.—Very slow response. They hardly ever disappear or become quiescent; it is better, therefore, to remove them whenever possible even after prolonged radiation treatment.
- (6) *Enlarged Glands due to a Mixed Infection*.—Enlarged lymphatic glands are met with in various parts of the body, and are usually due to one of the foregoing causes; but it must be clearly realised that the predominant cause need not necessarily be the only one; cases occur where there is a mixed infection, and these cases will, at times, behave in a manner which is disconcerting when an attempt is made to classify the type of gland according to the response to treatment, either by drugs or radiations.

The two groups where this disturbance is likely to occur are—(1) the tuberculous, and (2) the malignant.

In the former, it may be that only a percentage of the glands are infected with tubercle, the others being enlarged in consequence of some other infective process, or the tuber-

Treatment by X-Ray and Radium

culous infection may be implanted on glands which are already enlarged from a septic focus somewhere in the area drained by the same lymphatics; the response to treatment may then be irregular, a number of the glands subsiding rapidly, whilst others respond very slowly.

In the case of malignant glands it is not at all uncommon to find a number of glands enlarged where no trace of malignancy can be detected histologically; here again, a mixed response will follow on treatment, the non-malignant glands responding rapidly, while the malignant ones show scarcely any change after many radiations.

In the purely malignant glands the degree of involvement of the organ by malignant cells will also influence the result of treatment—such a gland may have only a very small focus of infected cells, the greater bulk of the enlargement being composed of inflammatory products which are reactive in nature to the invading malignant cells; here radiation treatment will aid the reactive process, and lead to the arrest of the extension of the malignant cell area, and ultimately cause its disappearance in fibrous tissue.

The treatment of the deeper glands can also be undertaken if powerful apparatus is employed and sufficient dosage administered; thus the enlarged thoracic and abdominal glands associated with tuberculosis or malignancy can be treated. The results are necessarily not very favourable so far as cure is concerned, but sufficiently so to encourage us to develop a better technique for use in these cases.

Two cases might be quoted in support of this method of treatment.

Name.
Sydney Bailey, 41.

Index No.

REPORT OF ELECTRICAL AND RADIO-THERAPEUTIC DEPARTMENT.

Date.

11th June 1917.—Patient nearly moribund, brought up on stretcher. Had operation (removal of a testicle) four years ago at St Thomas's Hospital. Present symptoms began two years ago. Pain in stomach, vomiting after food, swelling of abdomen, involving splenic area and beyond; also peritoneum. 1 P.D. to all areas of abdomen, three areas to be treated at each sitting three times a week, then to lateral aspects and back, 3 m.m. filter (seventeen areas in all).

Robert Knox

- 29th June.—Feeling very much better; no vomiting now.
Tumour appeared to be much smaller.
- 3rd to 14th July.—All areas repeated.
- 16th July.—Improved.
- 27th July.—Vomiting again; legs swelling.
- 31st July to 16th Aug.—All areas repeated.
- 28th Aug. to 14th Sept.—All areas repeated.
- 18th Sept.—Continued with X-rays particularly directed into pelvis.
- 25th Sept. to 30th Oct.—All areas repeated; patient still going on well.
- 2nd Nov.—Leg very troublesome, swelling, etc.; gentle massage given daily.
- 5th to 16th Nov.—X-ray treatment repeated to all areas.
- 19th Nov.—Leg improved.
- 20th to 29th Nov.—All areas repeated; still complains of pain in leg, but much less swelling; massage.
- 3rd to 14th Dec. }
17th to 31st Dec. } —All areas repeated.
- 31st Dec.—Patient has put on 15 lb. in weight since starting treatment; filter to be changed to 5 m.m. All areas to be continued, also 1 P.D. through each buttock, as large an area as possible.
- Jan. 1918.—Daily massage given to leg; X-ray treatment continued to all areas until 14th March. The patient did not attend after March until September.
- 20th Sept.—The patient had the treatment repeated to upper abdominal areas 5 m.m.; filter (Sept. to 10th Oct.)
- 18th Oct.—Patient was not so well; swelling of leg gone; felt sick and vomited a yellow fluid; no pain; bowels regular and tongue clean. No swelling in stomach.
- 25th Oct.—Feels better; no vomiting.
- 7th Nov.—Complains of pain at night; 1 P.D. 5 m.m. given to area of pain in back.
- 15th Nov.—Felt better; treatment repeated.
- 22nd Nov.—Leg swollen again, has pain all over body. Still at work. Stomach swollen a little again. Massage resumed to leg.
- 26th Nov. to 9th Dec.—X-rays repeated to all areas. Felt better. Leg still swollen. Massage continued.
- Jan. 1919.—Inspected, all treatment was to be continued, but patient did not come up again and died in May 1919.

Treatment by X-Ray and Radium

Name.

Albert Lee, 66.

REPORT OF ELECTRICAL AND RADIO-THERAPEUTIC DEPARTMENT.

Date.

3rd Dec. 1919.—Patient was sent for treatment and was admitted to Wolrige Ward, and had injections given by Sir C. Ryall's House Surgeon. Patient had a large mass of glands in both sides of neck and axilla, also in both groins. Legs and feet were very swollen and had varicose veins.

First X-ray treatment given 3rd December 1919. 1 P.D. to each side of neck and axilla, 4 m.m.

10th Dec. 1919.—Treatment repeated, also 1 P.D. given to each groin, 4 m.m.

17th Dec. 1919.—All areas repeated, glands diminished.

31st Dec. 1919.—All areas repeated. Patient has improved.

7th, 14th, 21st, and 28th Jan.—All areas were repeated and patient was discharged from the ward to the O.P.D. Much better.

4th, 6th, and 9th Feb.—Galvanism given to legs and blood count taken.

Blood count, 4th February 1920.

Red blood corpuscles	.	.	.	5,275,000
Leucocytes	.	.	.	12,000

Differential count—

Neutrophile polymorphonuclears	.	50	per cent.
Eosinophile	.	0.5	„
Endothelial leucocytes	.	2.6	„
Lymphocytes	.	23.5	„

There is a diminution relatively of polymorphonuclears and a relative increase of endothelial leucocytes. I have counted as endothelial leucocytes some which indeed may be very large lymphocytes, but at any rate they do not belong to the granular leucocyte class.

A. LEITCH, *Pathologist.*

11th and 18th Feb.—All areas repeated.

25th Feb.—Massage and galvanism to legs; this treatment was continued three times a week until 22nd March.

24th March.—1 P.D. 4 m.m. given to each axilla.

24th and 26th March.—Massage and galvanism repeated. Patient then went away for a holiday.

16th June 1920.—Patient reported himself quite well.

Robert Knox

An interesting case of lymphadenoma of an irregular type is most instructive in its progress.

A man, about 44 years of age, developed an irregular illness of a most baffling nature. A running almost septic temperature, general enlargement of the lymphatic glands, and marked blood changes gave place after a few months' treatment to the semblance of good health. He joined up soon after war broke out, and served in France for two or three years. On his return to England he remained well for a time, but later the disease reasserted itself and he became seriously ill. X-rays were tried without success, and he died; practically every gland in the body was enlarged. An interesting point in radiation therapy was shown in this case.

In the early stage of his illness the radiation employed was from a soft tube, and a great deal of superficial reaction followed the heavy dosage given; the skin which received the rays became deeply pigmented. Later, in the course of the illness, harder and more penetrating rays were used with a negative result. The difference in the wave length employed might account in some measure for the difference in effect, though it is frequently noticed that cases responding to radiation in the early stages refuse to do so later. This is one of the problems in technique.

CLINICAL NOTES OF THE CASE.

A. B., a stockbroker, a Londoner, never out of England.

Feb. 1914.—Taken with acute illness, gastric symptoms, general glandular swelling, rash, blotches, sore throat, fever.

R.B.C.: 5,400,000. W.B.C.: 26,700. Colour: 1.
Eosinophiles: 32 per cent.

July 1914.—Began radiation; continued at intervals towards the end of the year.

Oct. 1914.—Went into the country; gave up city work.

Nov. 1914.—Seen by consultant, who reported him in good condition; said he looked picture of health.

June 1915.—Found him looking very well, continued improvement.

W.B.C.: 17,600. Eosinophiles: 7 per cent.
Practically no palpable glands.

Oct. 1915.—Picture of health.

R.B.C.: 5,000,000. W.B.C.: 6000. Colour: 85.

Feb. 1916.—Examined and joined army.

Sept. 1916.—Was in France working at a Base in A.S.C.

Mar. 1917.—Still in France.

Treatment by X-Ray and Radium

Mar. 1918.—Returned from France.

May 1918.—Operated for hernia in London hospital.

July 1918.—Returned to Aldershot Depot; was given a commission.

Oct. 1918.—Was in hospital at Aldershot with enlarged glands.

Nov. 1918.—Came to London; went into London hospital with generally enlarged glands; morbid blood condition returning; was again radiated.

Feb. 1919.—General condition somewhat ameliorated; able to return home.

July 1919.—Returned to hospital.

Oct. 1919.—Died in hospital. Became emaciated to a skeleton, with an uncontrollable diarrhoea; a terminal enteritis.

P.M.—Bowel ulcerated from end to end like a dysenteric lesion; a mass of glands round the coeliac axis (of the Hodgkin type); extensive nodular infiltration of the spleen, which was of normal size; similar deposits in the vertebral column.

1920.—At a discussion at the Pathological Society of London; it was agreed the condition was the terminal one of an unusually chronic Hodgkin.

Diseases of the Uterus—Fibromyoma, etc.—It is only possible to deal at any length with the results obtained in a number of cases in which the patient has been seen from time to time. They are valuable as they afford striking evidence of the value of radiation treatment in these troublesome conditions.

Before dealing with a summary of results, it might be well to generalise on the subject and indicate points which will lead to fruitful discussion.

(1) We hear vague statements in reports and discussions of tumours having disappeared as a result of treatment. Now let us analyse a statement of this kind in connection with such a definite structure as a fibromyoma of the uterus.

I raise this point, because in one of the cases which appears in the tabulated results associated with my paper the statement is made "that no trace of the fibromyoma could be detected." This statement was made by the gynæcologist who sent the case for treatment—the tumour in the first instance was not a large one.

I do not for a moment believe that a well-developed fibroid ever disappears completely by any method of treatment other than the operative one, when the structure in which it is

Robert Knox

situated may at the same time be removed. If by X-ray treatment one could lead to the disappearance of the uterus and its adnexa, then I would admit the possibility of a fibroid also disappearing. What really happens is that the tumour is reduced in size to such an extent that it may not cause any obvious deformity of the uterus, and so cannot be detected by the usual method of examination.

It is, however, a common experience to find that there has been a marked diminution in the size of the tumour. A limited number of very large tumours have diminished to one-half or even one-third of the original size.

In a fairly large percentage of the cases treated there may be no diminution in size, or it is so slight that it cannot be detected by bimanual examination. In these cases the patient improves greatly in health presumably because of the arrest of the hæmorrhage, although a large abdominal tumour remains. In such cases the question of operation should be seriously considered.

It is not surprising that no marked change can be detected in these large tumours, especially when they are largely composed of fibrous tissue and are not very vascular. The radiation dose required to influence such tissue would be so enormous that the patient would be seriously damaged in the more superficial tissues. Any improvement obtained in cases of this type must be induced through the action upon the ovaries and the blood supply generally.

On the other hand, it is not wise to assume that because no great diminution in the size of a tumour is brought about, no good is being done. In cases of large inoperable tumours where pressure effects are present or are threatening, I have seen great relief obtained by a very small diminution in the size of the tumour. This particularly applies to the large tumour filling the pelvis and pressing upon the ureters.

(2) As regards the relief of symptoms, several of my most successful cases have been those of these very large tumours. The patients had refused operation.

The diminution in size in three of these cases has been remarkable; all symptoms disappeared, and the tumour in one case was reduced to one-third of its original size. These patients resumed their usual life occupations.

As a rule, it is the smaller and more active tumour which is most likely to be influenced by radiations and to show the

Treatment by X-Ray and Radium

greatest diminution in size and improvement in symptoms. A small tumour may give rise to very great hæmorrhage.

In cases where large tumours have been submitted to radiation, have undergone no change in size, and have been operated upon, it would be interesting to know if any change in the surrounding tissues and the tumours have been detected which could be reasonably attributed to the action of the radiations.

It would be interesting to learn from the gynæcologists of any after-changes in the uterus and other structures which might be attributed to the radiations. It is obvious that when treating a region such as the pelvis, other organs receive dosage equal to that administered to those requiring treatment. These organs may be disturbed. Several patients have complained of bowel disturbance; occasionally the bladder becomes irritable; these symptoms, however, soon pass off. Have any late effects been noted? I have not met with any, but they may occur.

I have not had an opportunity of seeing many cases operated upon after an extensive course of X-ray treatment; one or two results have been given me by gynæcologists and pathologists, and from these reports it has not been possible to detect to any appreciable extent changes induced in the tumour by the radiations.

One such example met with recently had been treated for over a year by X-rays and finally operated upon. The tumour was a very large one, showing the usual appearance of a fibromyoma. In the centre there was evidence of necrobiotic degeneration.

Next I shall endeavour to analyse the results obtained in a number of cases treated by X-rays. The bulk of the work has been carried out during the war, and it has been difficult to get accurate histories of the patients and the results of treatment. For our present purpose it will suffice to consider the results from two points of view:—

- (1) The effect upon the hæmorrhage.
- (2) " " tumour.

Nearly all the cases of menorrhagia dealt with have had an associated fibroid condition; one or two of the cases may not have had any, but as far as I can I have excluded this type of case.

The remarkable feature about the results is the large

Robert Knox

percentage of cases in which the hæmorrhage has ceased after a number of exposures. It is clear from a study of the cases that if the proper dosage is employed the hæmorrhage can be arrested, and the arrest may be permanent.

It is largely to the check of the hæmorrhage that the very marked improvement in the health and spirits of the patient is due.

A number of the cases treated improved, remained well for several months, and then the symptoms returned often more aggravated than before.

It is probable that the dosage had been insufficient, and that it should have been continued over a longer period of time. A number of these cases have been treated again with a satisfactory result. Others are at present receiving further treatment.

Another important point to discuss is the effect upon the tumour. I have recently been examining a number of fibroid tumours in the Pathological Museum of the Cancer Hospital, and from the observations made on the macroscopic structure, it is obvious that no quantity of radiation directed upon the tumour could lead to a great reduction in size. The fibrous tissue capsule and framework is already very firm, the interstitial tissue varies in density, and it is possible that if the blood supply is interfered with, degenerative changes may be induced which, leading to liquefaction and subsequent absorption of the material, may help to diminish the bulk of the tumour. The fibrous tissue will then contract, and ultimately a firm fibrous mass be formed which, under no circumstances, could be expected to disappear.

SYNOPSIS OF THIRTY CASES TREATED IN PRIVATE.

An analysis of 30 cases treated, or receiving treatment, in private, gives the following figures :—

- 20 could be considered as satisfactory. Symptoms cleared up and the general health improved. A number of these cases go back as far as 1913.
- 1 case improved but ceased attending after three treatments. No further information is available.
- 1 case did not improve at all and was operated upon after about six treatments.
- 1 case required a large number of attendances extending over ten months, but ultimately improved.

Treatment by X-Ray and Radium

5 cases are still attending for treatment, the result being so far very satisfactory.

2 cases are so far very unsatisfactory. One of these has since been operated upon.

HOSPITAL CASES.

Analysis of 18 cases treated:—

16 cases reported as satisfactory.

2 „ as unsatisfactory.

Among these cases the following points may be of interest:—

Mrs W.—At end of five treatments seen by gynaecologist who reported: “Fibroid can still be felt, but is very much reduced in size, and patient keeping well.”

Mrs S.—Treated from 15th March 1915 till 22nd July 1918. Report from gynaecologist, 27th September 1918, “*Exam.*—No trace of fibromyoma.”

Miss B.—Case treated for severe menorrhagia at periods—approaching climacteric—small fibromyoma. Treated from 18th November to June 1919.

Report from Private Doctor.—“Hæmorrhage entirely arrested. General health greatly improved.”

Mrs B., aged 42.—Treatment from 11th May to 4th October 1916.

Report from Gynaecologist.—“No further hæmorrhage. Symptoms of menopause. Size of abdominal tumour unchanged.”

Of the two unsatisfactory cases:—

(1) *Mrs B.*—Treated from 6th June 1918 to 3rd October 1919. Had eight treatments. Referred to gynaecologist on 25th September 1919 on account of an excessive period. No further report.

N.B.—This patient did remarkably well in the early stages.

(2) *Mrs V.*, aged 40.—Treatment from 5th May 1918 to 5th January 1920. Eleven treatments.

6th Jan.—Reported two weeks' excessive hæmorrhage following last treatment.

No further report.

It may be noted that in the treatment of these cases at hospital and in private the technique is practically identical.

(To be continued.)

A STUDY OF THE PNEUMOCOCCUS AND STREPTOCOCCUS GROUPS IN THEIR RELATION TO INFLUENZA.*

By W. R. LOGAN, M.D., F.R.C.P. Edin.; Clinical Pathologist,
Royal Infirmary, Edinburgh.

I.

THE plan of this investigation was a study of the pneumococci and streptococci from cases of epidemic influenza, firstly in their relation to the earliest stage of illness when the infection was presumably a comparatively pure one, and secondly, with regard to their part in the more advanced cases when pulmonary complications had set in.

The technique adopted in the study of these organisms will be given in detail elsewhere. Here it is only necessary to state that the bile test was adopted as the sole reliable means of differentiating pneumococci from streptococci, the macroscopic method described by the Rockefeller workers being used. The fermentation of inulin test, virulence to mice, capsule staining, presence or absence of hæmolysis on blood agar, power of growth on certain media, type of colony, homogeneity or granularity of growth in plain broth of a reaction referred to below, and morphology, were regarded only as secondary confirmatory tests, some being applied to all the isolated strains and all to some. The media used were always such as favoured the growth of the more highly parasitic pneumococci.

This rigid standard of differentiation being adopted, it will be evident that the term pneumococcus (bile soluble diplococcus) is used in a sense comparable to that in which it is employed by the American workers, and by Mair in this country, but differing widely from that in which it is used by the majority of British writers; of whom some have availed themselves of methods of differentiation which experimental work has shown to be inadequate, while others, to judge by the lack of evidence offered, are innocent of any standard of differentiation beyond the totally insufficient and misleading microscopical one, using direct films and films from cultures.

The cases may be taken as typical of those occurring in the Edinburgh district during the second and third waves of the epidemic, that is during those outbreaks which reached their

* Report to the Medical Research Committee; from the Research Laboratory of the Royal College of Physicians, Edinburgh.

Pneumococci and Streptococci in Influenza

height in November 1918 and in February 1919. One hundred and eight cases were examined completely as to the presence of pneumococci and streptococci, and are the subject of the present communication; seventy-five were civilians, the remainder soldiers.

From the cases of what for lack of a better term we may style "pure influenza," specimens were as a rule taken during the first three days of illness; from those with pulmonary complications naturally as a rule at a later stage, varying from three days upwards. Such a division is necessarily a somewhat arbitrary one; but the clinical condition of the patients, combined with the duration of illness at the time the specimen was taken, gave together a fairly satisfactory division of the cases studied into these two main groups.

In the uncomplicated cases, from whom as a rule no sputum was obtainable, a nasopharyngeal swab was used to obtain the material for examination, while from the pulmonary cases the sputum was usually employed.

Forty of these specimens were plated out direct on the medium favourable to the growth of pneumococcus, that is a blood-smeared fresh meat or bullock's heart agar of a reaction of +3 to +5 acid to phenolphthalein, with or without the addition of glucose or inulin, in the preparation of which the greatest care has to be taken to avoid overheating, and to ensure that the reaction is correct after sterilisation is complete; in the remaining sixty-eight, direct plating with, in addition, a preliminary passage through mice, and subsequent plating from heart blood and peritoneum was employed.

All strains were plated out twice to ensure purity.

II.—THE INCIDENCE OF PNEUMOCOCCI AND STREPTOCOCCI IN THE CASES.

This is demonstrated in Table I. :—

TABLE I.

	Cases Examined.	Pneumococci isolated from	Percentage of Cases from which Pneumococci were isolated.	Streptococci isolated from	Percentage of Cases from which Streptococci were isolated.
Pure Influenza in early stages	44	6	13.6	44	100
Influenza with Pulmonary complications	64	50	78.1	64	100

W. R. Logan

In reading these figures it has to be borne in mind that in the majority of the cases of pure influenza a nasopharyngeal swab was examined, in the majority of complicated cases a sample of sputum. Admittedly this favours the more frequent isolation of pneumococcus from the latter group of cases as compared with the former, and it would probably have given a higher percentage of positive pneumococcus results in the former group had the saliva been used. On the other hand, the use of nasopharyngeal swabs gave, what was aimed at, a more accurate index of infecting organisms as distinct from mere mouth saprophytes; while in the second group of cases the contamination of the sputum by mouth organisms was diminished as far as possible by washing the specimen in saline before emulsifying and proceeding to plate out or to inoculate into mice. It may also be observed that of eight nasopharyngeal swabs from cases with pulmonary complications four, or 50 per cent., yielded pneumococci, while the same method gave with forty-one cases of pure influenza only five positive for pneumococcus, that is 12.4 per cent.

The broad conclusions which could be drawn from these preliminary observations were that the pneumococcus group played little part in the cases of pure influenza, and could therefore be excluded from the list of suspected initiating agents; that its great increase in numbers in the cases suffering from pulmonary complications, having in mind the known pathogenicity of many pneumococci, suggested an important rôle in these complications; and that members of the streptococcus group were present in both simple and complicated cases. The next step was therefore to ascertain if these pneumococci in the secondary complications were of one type, and similarly if the streptococci of the simple and of the complicated cases differed on the one hand from each other, and on the other hand from the streptococci normally inhabiting the mouths of human beings.

III.—THE PNEUMOCOCCI.

One needs refer only very briefly to the work which has been carried on in recent years at the Rockefeller Institute in America,¹ and by Lister² in South Africa, upon the different serological types of pneumococci. It has been shown that pneumococci can be divided by careful agglutination tests,

Pneumococci and Streptococci in Influenza

using specific sera prepared against single strains, into two main groups; a group the different types of which are associated chiefly with acute lobar pneumonia, and another group which is in the main formed of types of pneumococci which are found in the mouths of about 40 per cent. of healthy individuals, and are apparently incapable of producing acute lobar pneumonia. Of the former group the two most important types are known as Type I. and Type II., and these two types alone are associated with more than half the cases of acute lobar pneumonia; Type III. pneumococcus, which is the mucoid type, is responsible for a certain number of cases of acute lobar pneumonia; while there are certain other types still awaiting a serological classification which are apparently capable of causing acute lobar pneumonia, but which in our present state of knowledge have to be included in the heterogeneous group. Of the latter group, known as Type IV., but which we shall refer to in this paper for reasons referred to below as Group IV., the types have not yielded to attempts made to classify them serologically, but it is known that the majority are found in the mouths of healthy individuals while a minority as just stated are associated with acute lobar pneumonia. Type III. pneumococcus provides an apparent exception to the rule in that, although capable of causing acute lobar pneumonia, it is also found in the mouths of a certain percentage of healthy persons; this deviation from the rule is, however, apparent rather than real, as there is reason to believe that the agglutination test as applied to this type provides certain fallacies owing to the mucoid character of the organism, and that improved technique will show the pneumococcus mucosus to contain at least two separate types. One may therefore make the generalisation that the types of pneumococci which cause acute lobar pneumonia are rarely found in healthy mouths, while the types of pneumococci which are found in healthy mouths rarely cause acute lobar pneumonia.

On the other hand in secondary broncho-pneumonias, as for example, after measles in children, it is as a rule members of the heterogeneous Group IV. which are found, and no satisfactory classification of these types is as yet available.

Types of Pneumococci obtained from Cases of Influenza.

Fifty-one strains of bile soluble diplococci from thirty-four cases of influenza were therefore typed out, using Rockefeller I.,

W. R. Logan

II., and III. sera. The reliability of the technique in such observations is obviously of the first importance, and a series of tests as to the best method of conducting this typing by anti-pneumococcal sera was therefore carried out, selected strains of pneumococci and streptococci being repeatedly tested by several methods and with different sera; the results are included in the paper dealing with the technical side of this inquiry.

For the purposes which are the subject of this present paper the macroscopic method was then adopted; in the primary rough separation of strains by agglutination with sera at the standard dilutions as laid down by the Rockefeller workers, the incubator at 37°C. was used, while in the final determination of the endpoint of the reaction the water-bath with a temperature of 55°C. was found to be more satisfactory. Where incubator temperature was used, it was found that much sharper results were given if the broth culture was first killed, either by heat at 55°C., or by adding 0.16 per cent. of formalin; the addition of 0.5 per cent. of carbolic to a heat-killed culture appeared to have the effect of lowering the titre. Agglutinable emulsions were not found to keep well. The typing with Type III. serum of pneumococcus mucosus did not yield satisfactory results, even where the modification of Porges' method of agglutinating mucoid organisms as adapted to pneumococcus mucosus by Hanes³ was used, and the classification of the strains falling in this group rests on a cultural basis. Owing to the peculiar cultural qualities of the organism such criteria may, however, be regarded as fairly sound in so far as they relegate these markedly mucoid strains to a particular group; for the separation of individuals within Group III. obviously cultural characters are inadequate.

The incidence of the types of pneumococci in these thirty-four cases is shown in Table II. :—

TABLE II.

Cases from which Pneumococci were typed.	Cases yielding			
	Type I.	Type II.	Type III.	Group IV.
34	3	3	2	26

These Group IV. pneumococci varied widely in their cultural characters, especially in the degree to which they leaned towards the mucoid type. Nearly all were virulent to mice, and

Pneumococci and Streptococci in Influenza

all gradations were observed between pneumococci which were not quite completely bile soluble, and which in other respects such as comparative hardness of growth and in a lack of that softness of colony which is characteristic of pneumococcus were little removed from the streptococcus group, and pneumococci with mucoid characters not very far short of that degree which would permit them to be classed as pneumococcus mucosus. Without question these Group IV. pneumococci comprised many different types.

An attempt was therefore made to subdivide these strains by means of serological tests, the method of immunising rabbits against pneumococci as published by Cole being adopted. In this method small doses of heat-killed pneumococci are given intravenously each day for a week; after a week's interval, a second daily series of six or seven intravenous injections is given; another week's interval follows, and finally a third series of intravenous injections is given and the animal is bled ten days after the last injection. This laborious procedure was carried out on six rabbits with six different strains of pneumococci. In not one of these animals were agglutinins formed in sufficient quantities to be used for the further differentiation of the strains.

It was found, as was to be expected from the published work of the Rockefeller workers, that a number of these Group IV. strains were agglutinable by Type II. serum used in proportions of equal parts of neat II. serum and broth culture, and would therefore fall into one of the Type II. subgroups of the American workers. An agglutination test with such a strength of serum introduces some obvious possible fallacies, and on repeating these tests with a number of strains consistent results were not obtained. The grouping by means of neat II. serum into II. subgroups was therefore abandoned.

A trial was next made with certain sugars to ascertain if a grouping of these heterogeneous strains by means of fermentation tests was feasible, although attempts in this direction have already been made by the American workers without practical result. A very serious difficulty in carrying out such tests with pneumococci is the uncertainty of growth on artificial media of many pneumococci, a fact well known to workers upon this group; even under the most favourable conditions some strains of pneumococci will suddenly die out, so that in keeping cultures going it is necessary to have two or three strings to one's bow,

W. R. Logan

and even with these precautions, strains are sometimes lost; this in spite of the media used being apparently suitable in composition and reaction, as can be demonstrated by the successful growth of other parasitic strains of pneumococci on the same batch of medium. In the second place, while certain sugars, of which, as will be demonstrated elsewhere, inulin is one, have a favourable influence on the growth of pneumococci up to the time that an acid reaction is produced, other sugars have no such favourable influence, and it is possible that some may be actually inhibiting. The capricious growth of these organisms adds, therefore, an additional and very real difficulty to the pitfalls which already beset classification of bacteria by sugar tests. The methods of carrying out the tests were identical with those described in Section IV., and the results will be described in the other paper. Here it is only necessary to state that the conclusions of the Rockefeller workers were confirmed; that no classification of pneumococci by their fermentation reactions was feasible.

A satisfactory subdivision of these Group IV. pneumococci was therefore not achieved, but, as indicated above, comparatively wide cultural variations in these organisms left one in no doubt that, in addition to Types I., II., and III., several distinct varieties of Group IV. pneumococci had been obtained. One of the questions before us had therefore already been answered—the pneumococci from cases of influenza with pulmonary complications were not of one but of several types.

Types of Pneumococci in Relation to Types of Clinical Case.

The failure to subdivide satisfactorily the Group IV. pneumococci prevented a minute comparison between the types of pneumococci present in healthy individuals and those present in cases of pure influenza; one was not able to go further than to ascertain that those from pure influenza cases were, like those from healthy individuals, members of Group IV., and that they were isolated from the nasopharynx of only 13 per cent. of these uncomplicated cases.

The eight strains of Types I., II., and III. pneumococci were, with one technical exception, derived from cases with well-marked pulmonary involvement, in each case with consolidation; the exception being a Type I. case from whose

Pneumococci and Streptococci in Influenza

nasopharynx the organism (kindly handed over to me by Dr Horne) was isolated at a time when she was apparently suffering from pure influenza; she manifested pulmonary symptoms within a day or two, and died within a week of pneumonia. One of the Type II. pneumonias was a lobar pneumonia in which the existence of influenza was regarded by Major R. A. Fleming, under whose care he was, as doubtful.

The Group IV. pneumococci were isolated from cases of pure influenza; from cases of influenzal bronchitis; from cases of influenzal bronchopneumonia; and from cases in which, as shown both clinically and by post-mortem examination, extensive consolidation was present. They were isolated from cases in which the illness was trivial; from cases in which a very chronic chest condition supervened, and from cases with a rapidly fatal termination. That these Group IV. pneumococci were alone responsible for the pulmonary complications in these cases is not suggested, and there was evidence that other organisms, such as staphylococcus aureus and hæmolytic streptococci, played an important part in some, while the part played by B. Pfeiffer was untouched on in this investigation. On the other hand, many cases yielded from the sputum such superabundant growths of pneumococci that it was difficult to believe that the part played by them in the secondary complications could be other than very important.

The Origin of the Pneumococci.

As regards Types I. and II., it has already been stated that these types do not inhabit normal mouths, and their presence in certain cases of influenzal pneumonia is therefore evidence of an infection from without.

Turning to the inagglutinable varieties, the figures would at first sight seem to suggest that as Group IV. pneumococci are the variety which is to be found in a fair percentage of healthy mouths, their presence in these complicated cases of influenza only means an overgrowth and secondary invasion of the lung by types previously present as saprophytes in the mouth of the patient. There is actually no proof whatever that this is the case. Group IV. pneumococci are not a "type" of pneumococcus; even the term "group" is to some extent misleading. They are merely pneumococci which are not Types I., II., or III., and of which no further classification is,

W. R. Logan

up to the present, available. There is, therefore, no exact serological proof as to whether these Group IV. pneumococci are, or are not, infections from without. Other evidence on the point is gone into in a later section.

IV.—THE STREPTOCOCCI.

The differentiation of streptococci into types rests on no such reliable serological basis as does that of the chief pneumonia-producing types of pneumococci. There is, however, one fairly though not absolutely reliable means of dividing the streptococcus group into two main subgroups: the hæmolytic test. Hæmolytic streptococci are, in the main, virulent, and rarely lead a saprophytic existence, while non-hæmolytic streptococci include the saprophytic types, along with a certain number of pathogenic varieties.

This test, as referred to here, consisted in the production or not of a clear zone round a colony or agar mixed with fresh rabbit or human whole blood, the observation being made when the colony was not less than one day and not more than two days old. The formation of a very narrow or transient zone of apparent hæmolysis was disregarded, only those strains being regarded as "hæmolytic" in which a quite definite clear broad zone was present at the end of twenty-four hours. This fact is of importance as other workers have included as "hæmolytic" strains which by the standard here adopted would be classed as "non-hæmolytic." The production of hæmolysis in broth cultures of varying age is a process involving different factors, and not comparable to the "hæmolytic" test as carried out for the differentiation of strains. Pneumococcus, for example, although "non-hæmolytic" in the sense used here, produces hæmolysins in old cultures.

As stated in Section II., streptococci were isolated from 100 per cent. of cases, both of pure influenza and of influenza with pulmonary complication.

Incidence of Hæmolytic and Non-Hæmolytic Streptococci.

One hundred and nine strains of streptococci derived from fifty-seven cases were subjected to this test; twenty-eight of the cases being of pure influenza, twenty-nine of influenza with pulmonary complication. Eleven of these strains, derived from eight cases, were found to be definitely hæmolytic, and

Pneumococci and Streptococci in Influenza

all of these eight cases were of influenza with pulmonary complications.

These figures are tabulated in Table III.

TABLE III.

	Hæmolytic Test applied to Streptococci from	Hæmolytic Streptococci obtained from	
		o Cases	o% of Cases
Pure Influenza in } early stages . }	28 Cases	0 Cases	0% of Cases
Influenza with Pulmo- } nary complications }	29 Cases	8 Cases	28% of Cases

The Hæmolytic Streptococci.—One was, therefore, able to come to the same conclusion concerning the hæmolytic streptococci as had been arrived at with regard to the pneumococci: there was evidence that they played no part in the production of pure influenza, but they were apparently active as secondary invaders of the lungs in more than a quarter of the cases with pulmonary complications, as compared with the figure of three-quarters of the cases obtained for the pneumococci.

The hæmolytic streptococci from two cases were tested in sugars, Holman's tests being used (see below); one case yielded streptococcus pyogenes, the other streptococcus anginosus. The hæmolytic streptococci, like the pneumococci, were therefore apparently of more than one type. All were virulent to mice.

The fact that these strongly hæmolytic streptococci do not as a rule inhabit healthy mouths, that they were not found in the cases of pure influenza, but were obtained from 28 per cent. of complicated cases, is sufficient proof that they at least were infections from without.

The Non-Hæmolytic Streptococci.—As has been shown, non-hæmolytic streptococci were obtained from all the cases examined save two. It was significant that these two exceptions, where hæmolytic streptococci were apparently in pure culture, were cases from which the material examined was lung substance in one case (post mortem) and empyema pus in another; in all the complicated cases where sputum was examined, non-hæmolytic streptococci were obtained, in addition to other organisms. Although the sputum was carefully washed

W. R. Logan

in saline, it was not easy to exclude the possibility of contamination with mouth organisms in at least some of the cases; it being known that the mouths and throats of practically all people harbour non-hæmolytic diplostreptococci, it was necessary to make an attempt to determine whether the streptococci from the influenza cases were identical with or different from those in normal mouths.

Morphologically these non-hæmolytic streptococci were not distinguishable from the ordinary saprophytic varieties. They were pleomorphic diplostreptococci, rarely growing in chains, and varying greatly in size, some very minute types being observed. Sometimes round, but usually oval or even lanceolate in shape, they frequently showed with Gram's stain an unstained surrounding halo, and many were indistinguishable morphologically from pneumococci. Some tended to lose their Gram-positive quality more easily than others. A few produced coccobacillary forms so that one was in doubt whether to class them as streptococci or as diphtheroids. A few others showed a similar tendency towards a staphylococcal type. There was great variety in the type of colony produced, in size, regularity of shape and outline, and consistency. Many were of the type which has been called streptococcus viridans, that is, they produced greenish colonies on blood agar; but this character is not one of value in distinguishing strains of non-hæmolytic streptococci from one another. Their pathogenicity to mice was consistently very low.

None of these qualities, however, are sufficiently fixed or sufficiently specific to be used for purposes of differentiation. No serological classification of these organisms is as yet available, and the only method remaining is a classification by fermentation tests; the special difficulties which such tests present in the case of the pneumococci have not to be faced when dealing with streptococci.

Holman's⁴ classification was, therefore, adopted, Hiss's serum water media being used, with litmus as an indicator. The inoculations of the media were always made with sterile pipettes from young broth cultures in amounts of about $\frac{1}{2}$ c.c., a plain broth tube being always inoculated at the same time, and where no growth occurred in this broth tube or a contamination, the results of that particular organism were discarded. Several controls of each sugar from the same batch of medium were always incubated at the same time for a week, and where,

Pneumococci and Streptococci in Influenza

as happened on two occasions, it was seen that changes were taking place, in one instance due to overheating of the medium, and in the other to underheating with contamination, all that batch of results was discarded. The readings were made on the first, second, and third days of incubation, a result being classed as negative where no change had taken place in the medium before the end of the third day.

Table IV. illustrates Holman's classification; the sign + stands for the fermentation of the sugar with the production of acid and clot, while - signifies that the reaction remained unchanged.

TABLE IV.

	Lactose.	Mannit.	Salicin.	
Hæmolytic	+	+	+	Infrequens.
	+	+	-	Hæmolyticus I.
	+	-	+	Pyogenes.
	+	-	-	Anginosus.
	-	+	+	Hæmolyticus II.
	-	+	-	Hæmolyticus III.
	-	-	+	Equi.
	-	-	-	Subacidus.
Non-hæmolytic	+	+	+	Fæcalis.
	+	+	-	Non-hæmolyticus I.
	+	-	+	Mitis.
	+	-	-	Salivarius.
	-	+	+	Non-hæmolyticus II.
	-	+	-	Non-hæmolyticus III.
	-	-	+	Equinus.
	-	-	-	Ignavus.

Of the non-hæmolytic strains, 90, derived from 46 cases, were put through this series of tests. In 13 of these the salicin test was omitted. The remaining 77 strains gave the results shown in Table V. :—

TABLE V.

Fæcalis.	Non-hæmolyticus I.	Mitis.	Salivarius.	Non-hæmolyticus II.	Non-hæmolyticus III.	Equinus.	Ignavus.
0	1	44	26	1	0	0	5

Of the 13 incompletely tested strains, 9 were either mitis

W. R. Logan

or salivarius, 4 either *fæcalis* or non-hæmolyticus I. The 90 strains may, therefore, be grouped as shown in Table VI. :—

TABLE VI.

Non-hæmolytic Strains.	Mitis and Salivarius.	Other Varieties.
90	79	11

As several strains from one case were sometimes tested, these figures do not give quite a correct impression of the incidence of these varieties in regard to cases. From some cases several different varieties were obtained; from some three or four strains were all found to have identical reactions. It is to be noted that in making several cultures from a plate an endeavour was always made to subculture from colonies which showed differences, and this naturally favoured the isolation from the same case of strains giving different fermentation reactions. Of the 46 cases from which the streptococci were tested in this way, 22 were of pure influenza, while 24 had already pulmonary complications at the time the organisms were obtained. Of these 22 cases of pure influenza, only one failed to yield either mitis or salivarius or both; while of the 24 pulmonary cases, 22 yielded mitis or salivarius or both.

Apparently, therefore, the great bulk of the streptococci were of two types, types which are commonly met with as saprophytes in the mouth, although one, mitis, is also met with in pathological conditions such as, for example, endocarditis. But it must be made clear that this simplification of the problem was more apparent than real. Morphological and cultural differences may be in themselves insufficient for classification and yet be sufficiently definite to leave no doubt in the mind of the observer that different types of organisms are being dealt with. This was certainly the case with regard to some of the strains of streptococcus mitis examined. Most were culturally and morphologically indistinguishable, but some showed quite definite cultural and morphological differences from the standard type. In addition, while the majority of these strains did not ferment inulin, from time to time strains giving the sugar reactions of streptococcus mitis were met

Pneumococci and Streptococci in Influenza

with which were inulin fermenters. These were quite readily distinguishable from pneumococci, not only by the bile test, but by other characters, and that they were definite inulin fermenters was shown by the fact that on repeating the tests with certain strains some weeks later, they still retained this quality, while in two cases from which several strains of mitis were examined, all were found to be of this inulin-fermenting type. It was quite evident that in these two cases, at all events, the saprophytic streptococci had been replaced by streptococci of a different kind, although Holman's tests taken by themselves would have given no inkling of this fact.

The conclusion was arrived at that the use of Holman's tests would only be useful if they were used as a preliminary rough guide to some such specific test as the agglutination test, just as lactose, glucose, and mannit are helpful in the first rough grouping of the typhoid-dysentery organisms before the application of the specific sera; that a type as determined by such tests might actually include organisms of greatly varying pathogenic properties, just as bacilli giving the sugar reactions of *B. Flexner*, if one were to rely on these sugar tests alone, might include very potent dysentery producers along with organisms without the capacity to produce true dysentery, and even such a widely different organism from the disease-producing point of view as *B. typhosus*; and that even granting that these organisms are stable from the point of view of their sugar reactions, these tests are insufficient, taken alone, to solve the problem as to whether these organisms in the influenza cases are the same types as normally lead a saprophytic existence in the mouths of individuals.

Exact scientific proof on the matter being lacking, one had, therefore, to be content with what the rest of the evidence suggested as the greatest probability. The view was taken that the low pathogenicity to mice of these organisms, the fact that they were non-hæmolytic, and the close resemblance borne by the great majority culturally, morphologically, and in fermenting powers to ordinary saprophytic streptococci, rendered it in the highest degree improbable that they were responsible as initiating agents in the epidemic; while as to their rôle in the secondary complications, there was little doubt that some members of the group, and possibly even the saprophytic varieties, played a part in the complicated cases, at all events after lung changes had already taken place.

W. R. Logan

V.

Accepting, therefore, as proved, that the pneumococci and the hæmolytic streptococci played no part in initiating the epidemic, but played an important part in the secondary complications, and that at least certain of the non-hæmolytic streptococci also played a part as late invaders of the lung, it may be asked if these facts throw any light by analogy or by inference on the origin of the epidemics. As has already been emphasised, there has been a tendency to accept Group IV. pneumococci as something of an entity and to assume that because pneumococci of this group are present in a considerable percentage of healthy mouths, their presence in the lungs of cases of influenza with secondary complications would necessarily infer an acquirement of virulence by, or an increased susceptibility towards, the patient's own saprophytic type of pneumococcus; it must be very clearly laid down that there is no proof that this is the case; there is no proof, that is, that the development of secondary pulmonary complications in influenza can take place in the absence of *foreign* types of pneumococci or streptococci, using the word foreign to signify pathogenic types not carried by the majority of normal persons. As has been demonstrated, in some of the cases the pneumococci were of types which are known to be pneumonia-producing and which do not ordinarily occur in healthy mouths: in some hæmolytic streptococci were obtained of kinds which likewise do not occur in healthy mouths: and the inference is that at least some of the Group IV. pneumococci in these cases in like manner are foreign pathogenic varieties, although limitations of technique prevent us at the present time from bringing exact proof one way or the other.

Such reservations must be taken to apply only to the onset of the pulmonary complications; there is abundant proof that once these complications have occurred almost any organism which happens to be present may overgrow in the lungs, and it is probable that the saprophytic streptococci found in these cases (and probably also saprophytic pneumococci) are in the nature of "tertiary" infections.

In emphasising the possibility that such of the Group IV. pneumococci as are active in initiating the pulmonary complications in certain of these cases may, like the Types I. and II. pneumococci and hæmolytic streptococci, always be foreign

Pneumococci and Streptococci in Influenza

varieties, it is necessary to point out that it is not a *sequitur* to such a hypothesis that the acquirement of even highly pathogenic organisms of these groups is necessarily followed by pulmonary complications; there is abundant evidence that this is not the case, and that a personal hypersensitiveness, which may be interpreted either as a hypersensitiveness to particular bacterial groups or as a particular tissue hypersensitiveness to bacteria generally, plays at least as important a role in these as in other bacterial infections.

Accepting, therefore, that these pathogenic varieties are certainly in some cases, and possibly in all, infections from without, it will be asked at what period in the illness these infections take place; are they synchronous with the original infection, although requiring a longer incubation period; or do they take place at a later date? On a re-examination of the figures it at first seemed that the infections could not be synchronous, as these pathogenic varieties of pneumococci and streptococci had scarcely ever been isolated from the cases of pure influenza; but on going into the later history of the cases, the rather peculiar fact emerged, that scarcely any of the cases which were examined as pure influenza cases had later developed pulmonary complications; and that the one notable exception which could be traced was the case already referred to from which the pathogenic Type I. pneumococcus was obtained when she was suffering from pure influenza, and who later developed pneumonia and died. Here, then, was additional proof that in the absence of infection with pathogenic types of pneumococci and streptococci, pulmonary complications did not take place; but evidence of the exact time at which infection by these organisms occurs was not available. To most this exact proof will be superfluous as it can scarcely be doubted that infection with these foreign pneumococci and streptococci must take place from patient to patient during an epidemic, and it is reasonable to assume that in some cases this infection is synchronous with the original one, but that in others it may occur at a later date, as in a hospital ward or other sick room containing more than one patient.

Serum Treatment.—The multiplicity of types of bacteria responsible for the pulmonary complications puts out of court at once any possibility of effective serum treatment in the majority of cases. The only curative serum so far successfully prepared against pneumococci is that produced (at the Rocke-

W. R. Logan

feller Institute) against Type I. pneumococcus; and this serum is specific in that it has no curative value in pneumonias due to other types of pneumococci. Claims have been made that a fairly effective serum has also been prepared against Type II. pneumococcus, but against other types no serum of value exists. Sera prepared against different types of streptococci are probably equally specific, and their value in the treatment of these cases correspondingly limited.

Prophylactic Vaccines.—The proof that many of the organisms active in the secondary complications are infections from without, carries with it the necessity for the inclusion of these organisms in a vaccine which is intended to provoke the production of specific anti-bodies; it is not necessary to include the saprophytic types.

Summary of Conclusions.

It will be unnecessary to recapitulate the figures which have been given in the different sections, while conclusions as to the technical details can more fittingly be incorporated in the second paper. Here we may briefly summarise such of the main conclusions as throw any light upon the epidemiology of influenza.

It was shown that pneumococci and aerobic streptococci could be cleared of suspicion of acting as the initiating organismal cause in the epidemics; that the pathogenic organisms of these groups which were associated with the production of pulmonary complications were of a variety of types; that many of these were definitely infections from without, while with the remainder limitations of technique prevented exact proof as to their origin being brought; that the presence of saprophytic streptococci and of presumably saprophytic pneumococci in the lungs of many advanced cases may be explained as a late invasion of the already diseased lung, either by the patient's own mouth organisms, or by the saprophytic mouth organisms passed on from another patient, while their presence in the sputum is, in many cases, due simply to a contamination of the specimen with organisms from throat and mouth.

From this point of view influenza may then be regarded as divisible into three stages:—A primary stage, when the unknown infecting virus is apparently *acting* alone, though presumably frequently accompanied by other organisms which

Pneumococci and Streptococci in Influenza

may, or may not, later be able to develop a like activity; a secondary stage, when pathogenic pneumococci and streptococci are active in producing pulmonary complications; and a tertiary stage, when saprophytic mouth organisms may invade the already diseased lung. While this is the bacteriological history of an individual case, it is probably also a fairly accurate bacteriological history of the epidemic itself.

It was emphasised that the hypothesis that pulmonary complications might never occur in the absence of the particular types of pneumococci and streptococci which are associated with lung changes but which do not occur in healthy mouths, does not include the corollary that "infection" by these organisms is necessarily followed by pulmonary complications.

It was shown that the type of pulmonary complication is, to a considerable extent, dependent on the type of pathogenic pneumococcus or streptococcus present; that pneumococci of Types I., II., and III. were associated with pneumonias with extensive consolidation, as were also certain of the Group IV. pneumococci; and that others of this group and the hæmolytic streptococci were associated with complications of the broncho-pneumonic and bronchitic types.

The part played by other organisms, notably B. Pfeiffer, was not investigated in this series of cases; staphylococcus aureus was evidently playing an important part in some, associated, as might be expected, with a very purulent condition of the lungs; in many the presence of large numbers of cocci of the catarrhalis and allied chromogenic varieties was noted; diphtheroids were of common occurrence.

The presence of complex infections in epidemics of this kind does not imply that the original bacterial cause at the beginning of the outbreak was not a single type of micro-organism; nor does proof that an infecting organism is of a type foreign to normal mouths, convey with it any suggestion that a temporary susceptibility, individual or general, due to causes at present unknown, is not the prime factor in the initiation of such epidemics.

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W. R. Logan

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REFERENCES.—¹ Avery, Chickering, Cole, and Dochez, *Monographs of the Rockefeller Institute for Medical Research*, No. 7, 16th Oct. 1917. ² Lister, *Publication No. 2 of the South African Institute for Medical Research*, 1913. ³ Hanes, *Journ. Exp. Med.*, 1914, xix. 38. ⁴ Holman, *Journ. Med. Research*, 1916, xxxiv. 377.

Note.—Advance reports on the same subject have already been communicated elsewhere. The present report was sent to the Medical Research Committee in April 1920; a brief abstract has appeared in the *British Medical Journal*, 5th February 1921.

WHERE DO WE STAND IN PREVENTIVE MEDICINE ?

By WM. ROBERTSON, M.D., D.P.H.

IT is difficult to say whose fertile mind inspired the idea of doles. It is certain, however, that in the course of one's travels few, if any, are found to agree with the principle. To a certain section of our population State aid appears to be a corollary to existence. The old spirit of civic independence is sleeping, and the soporific appears to be doles from the State. The most recent exploitation of a scheme for the conversion of the medical practitioner into a glorified penny-in-the-slot machine clearly indicates how strongly the currents of some minds are flowing in the direction of tinctured Socialism.

This contribution is not meant to discuss the question of State-aided practice, but rather to inquire into the position of present-day Preventive Medicine. And, at the outset the opinion is hazarded that had the State done its duty in the past, the need for the present agitation in favour of kaleidoscopic social reforms would not have arisen. That assertion may be immediately questioned. But, let us take Housing as a practical illustration. Different political parties have placed Housing Acts on the Statute Book from time to time. Powers were granted in these Acts for adequately and completely dealing with the improvement of the admittedly wretched housing conditions that were to be found in almost every community throughout Great Britain. Local authorities made spasmodic attempts to tackle the problem. Medical advisers, without exception, urged upon civic rulers the clamant need there was to prevent the spread of tuberculosis by going to the very root of the cause. Clearing away of slums, opening up of congested areas and the provision of simply constructed yet airy houses, were outstanding recommendations. Little progress was made. Why? Because the question of pounds, shillings, and pence obtruded itself. "Why," it was asked, "should one section of a population be provided with houses at the expense of another? Let private enterprise make the attempt. We refuse to be parties to any such non-profit-yielding scheme." Private enterprise did nothing, for the simple and material reason that houses must be built to pay. Private enterprise never pretended

William Robertson

to masquerade in the guise of a philanthropic agency. So the whole problem was left unexplored and practically untouched. It is here that the State should have intervened with a metaphorical big stick. The Housing Acts gave the State the power to provide the stimulus of compulsion. A little far-sightedness would have avoided a vast amount of the present-day expenditure upon housing. It is easy to be wise after the event, but the event was foreseen by many, since the question of preventing tuberculosis was always discussed from the point of view of better housing conditions, with improved social environment for the people.

The irony of the whole situation consisted in the fact that civic authorities had no hesitation whatever in raising the rates in order to treat the conditions caused by bad housing. Prevention was quite another story.

The erection of Sanatoria and the initiation of such schemes as that pioneered by Sir Robert Philip become lines of offence and defence against an exasperatingly slow attack. The next stage reached was the present one. In order to stimulate action the State dangled the dole, called the grant, before the eyes of Local Authorities. For every £100 spent by a Sanitary Authority in *treating* cases of tuberculosis, the State promised to repay half. Next came the war, followed by the popular cry of "houses fit for heroes." Even the people who jeered at the heroes while the war was going on, took up the refrain, and every one joined in the chorus. We are now crying aloud for houses, the vast majority of which could have been provided ten years ago at ridiculously low costs as compared with the present.

This is neither the time nor the place to discuss the type of house that is now being erected to solve this side of the problem of Preventive Medicine. It is nevertheless true to say that the class of dwelling anxiously sought by the Preventive official is conspicuous by its absence. The slum-dweller is still looking for something better than his present abode. He cannot afford to occupy a four or five roomed establishment. One is tempted to digress and to expatiate upon "ca' canny" methods, Trade Unions, and so on, but that would be like beating the air. The facts are before us and we can make no more of them. It is pretty certain, however, that the man who finds taxation eating into his slender and fixed resources will ultimately rebel against further inroads into his treasury. The

Where do we Stand in Preventive Medicine ?

housing question is a national one. It was neither designed to keep tradesmen employed at fixed rates of wages, nor to compel the taxpayer to look on while the Trade Unionist worked at a speed that suited the rules of a Society. The onus of providing houses should now be laid upon the shoulders of the people who demand them. Until joiners, bricklayers, masons, painters and other tradesmen make up their minds to expedite the erection of houses the whole scheme should be scrapped. The dole is proving a pernicious evil. And doles, or grants, will be but sops as long as they continue. Meantime Preventive Medicine is waiting for relief. The Tuberculosis Officer still sees his relays of patients, and sanatoria are in many places unable to cope with the demands made upon them. One regrets to strike the chord of pessimism ; but we must continue to bang another alleged musical instrument and drum the melody of Prevention into the ears of those who have it in their power to solve it.

Child Welfare is another problem that has been favoured with grants of fifty per cent. How closely related housing and environment are to many of the affections of childhood everyone knows. It cannot be asserted that the solution of the housing question will do away with the need for Child Welfare expenditures, but better homes for the people will unquestionably raise the moral and physical tone of fathers, mothers, and children. The appeal to the Clinic and Convalescent Home would, under improved civic surroundings, not be so frequently made. But one must not forget that more could be done to obviate ignorance in the feeding of young and old if our girls were properly trained by qualified women in the craft of motherhood. It is a reflection on our present-day methods of education that many mothers attend mothercraft, sewing, and other classes, for the first time in their lives at one or other of our present-day Child Welfare establishments. When we are striving so strenuously to prevent disease by trying to establish healthy conditions among our citizens, one of the most certain short cuts seems to be early training in practical domestic life and economy.

Then again we are faced with the problem of unsatisfactory milk supplies. Government is always going to do something. An Act is ready for operation. It has been held up by the aftermath of the war. It is called The Milk and Dairies (Consolidation) Act, 1915, and is intended to come into opera-

William Robertson

tion not later than one year after the termination of the war. It is designed to prevent the sale of Tuberculous Milk. It also will give powers to Local Authorities to establish Milk Depots. Sect. 3 of the Act empowers the M.O.H. of a County or County Borough to stop the supply of milk if he is of opinion that tuberculosis is, or is likely to be, caused by it. When the Act is placed in the hands of a progressive Sanitary Authority much progress on the preventive side of Child Welfare will be made.

Experience has shown that advantage is being well taken of Child Welfare Schemes, but not in the directions that always appear most desirable. Day Nurseries and Clinics are in constant demand, but the Convalescent Home does not appear to find full favour with the mothers. The benefits following a brief sojourn in one of these institutions brings into bold relief the outstanding importance of good environment. Clean bodies, clean beds, simple and regularly served meals, clear air and fixed hours for going to rest soon work wonders. But, alas, the clear eyes, chubby cheeks and bright smile are quickly dispelled by a return to the conditions that compelled the child to go to the Convalescent Home. The benefits of the clean, regular, life point the finger straight at the need for better home conditions. Thus, the question of Prevention is again made the outstanding one. It is mainly the Clinical and Curative side of a big social problem that is being attacked with the help of doles.

Lastly, we come to the subject of Venereal Diseases. The war has fanned the flames of infection into a blaze of disease. The extent of Venereal Disease in the army almost staggered one. We are now dealing with the dregs. In this case the dole is substantial, and while the community pays £25 out of every £100 spent in treatment the taxpayer of the country contributes £75. In no branch of the Army Medical Service was better work done than in treating Venereal Diseases. It was fortunate that that should have been so, since the training received by many has provided the nation with a well drilled brigade of skilled medical and lay men. One has only to visit the centre at the Royal Infirmary to appreciate how methodically, scientifically, and thoroughly the work is being done. The majority of those engaged in the task had been trained in one or another V.D. military hospital. But, when we come to discuss the question of Prevention we realise how little is being done. The stream of cases seems to be never-ending. The

Where do we Stand in Preventive Medicine ?

source is not touched as one feels it ought to be touched. Those of us who have seen the disease in its actual nakedness clamour for that help that will place the power in our hands to seize hold of those who are neglecting treatment and in too many cases wilfully spreading infection. There is a good field open for discussing the question of some form of notification. The subject will require to be resolutely faced, no matter how difficult the proposition may appear to be. We cannot very well go on pumping "914" into veins and mercury into muscles if we are not to see some hope of betterment in the direction of preventing much of the spread of infection. The people who neglect treatment and continue to spread disease should be brought to book.

The notification required is not so far-reaching as that now in vogue for other acute infections. A scheme has been in operation in Australia, New Zealand, and elsewhere. The latest official report from Australia is to the effect that the number of notifications for 1920 has doubled, as compared with 1919. The preventive side of medicine is anxiously waiting for help in this serious social problem.

CRITICAL REVIEW

CALMETTE'S PROTECTIVE VACCINATION OF CATTLE AGAINST TUBERCULOSIS, AND ITS POSSIBLE APPLICATION IN MAN.

By THEODORE SHENNAN, Professor of Pathology, Aberdeen.

IN a paper published in 1913, Calmette and Guérin reported the important observation that, by growing bovine tubercle bacilli upon bile-glycerine media through a long series of sub-cultures, they obtained a strain of attenuated bacilli which were non-pathogenic to cattle, monkeys, and guinea-pigs. This strain was well tolerated by these animals even when injected intravenously in considerable doses, producing no tuberculous lesions, and conferring upon cattle especially, after thirty days, an immunity to virulent bacilli injected intravenously. The duration of this immunity had still to be determined, when the vaccinated cattle were brought into constant contact with known tuberculous cattle. This problem forms the subject of a recent article by the same authors, which appeared in the *Annals* of the Pasteur Institute (September 1920).

The experiments, begun in 1912, were "rudely interrupted" in 1915 during the German occupation of Lille, and the manner in which Calmette and Guérin circumvented the invaders, and carried the experiments to a conclusion, makes interesting reading and excites our admiration.

For the purposes of the experiment a special cowshed was devised, in which the animals were placed in two rows of stalls, one behind the other, with the front row on a slightly higher level, so that the dejections washed along by the urine constantly contaminated the bedding and food of the animals in the second, lower, row of stalls. In the front row were placed five manifestly tuberculous cattle; and, moreover, the cow-shed had been occupied for two months previously by five tuberculous cattle. In the second row, ten cattle, certified by inoculation to be free from tuberculosis, were placed. Six of the ten were vaccinated, and the remaining four acted as controls. The number of tuberculous cattle was always kept at five, those dying being replaced by other cattle known to be tuberculous, altogether ten tuberculous cattle being used during the thirty-four (three?) months covered by the experiments. In eight of them post-mortem examination revealed extensive tuberculosis, and in the other two, a less severe infection.

Vaccination of Cattle

The disposition of the cattle was as follows :—

	1	2	3	4	5					
	(Tuberculous cattle.)									
	C	V	V	C	V	V	C	V	V	C
Nos.	40	41	42	43	44	45	46	47	48	49
	(Non-tuberculous cattle.)									

C = Control cattle, not vaccinated.

V = Vaccinated cattle.

In November 1912, each of the vaccinated cattle received by way of the jugular vein an injection of 20 mg. (880 millions) of bovine bacilli, from the seventieth sub-culture of the strain upon bile-potato medium, two weeks old. After a year, a second injection of the same amount was given to Nos. 41, 44, and 47, but not to Nos. 42, 45, and 48. Then after another year, a third injection was given to Nos. 41 and 44 only.

At the end of the first year (November 1913) the ten cattle, six vaccinated and four controls, were submitted to a tuberculin test, with the following results :—

	C	V	V	C	V	V	C	V	V	C
Nos.	40	41	42	43	44	45	46	47	48	49
Tuberculin Test	+	-?	-	+	-	+	-	-	-?	+
Febrile Reaction	2.5	1.1	0.3	1.9	0.8	1.8	0.2	0.8	1.0	2.5

+ = Positive reaction.

- = Negative reaction.

- ? = Doubtful reaction.

All the ten cattle were in a satisfactory state of health, and their increase in weight was regular and uniform.

The results of the tuberculin test were taken to indicate the existence of tuberculosis in three out of the four controls; but the explanation of the one positive and two doubtful reactions in the vaccinated animals was not clear. It was supposed that the presence of a-virulent bacilli in the organism can sensitise to tuberculin.

In conformity with the programme planned out, Nos. 41, 44, and 47 at this time received a second injection, from the 89th sub-culture, a twenty-one days' old culture.

In June 1914, a second tuberculin test was carried out, and resulted as follows :—

	C	V	V	C	V	V	C	V	V	C
Nos.	40	41	42	43	44	45	46	47	48	49
Tuberculin Test	+	-	-	+	-	-	-	-	-	+
Febrile Reaction	1.4	0.7	0.6	2.5	0.5	0.9	0.5	0.7	0.2	1.2

Therefore, after eighteen months of living in close contact with tuberculous cattle, the six vaccinated animals were negative to the

Theodore Shennan

tuberculin test, whereas three out of the four controls were manifestly infected; the fourth control, which still showed a negative reaction, showing evidence of an individual resistance, even under conditions highly favourable to infection.

In November 1914, two years from the beginning of the experiment, in consequence of the German "Curfew" orders, the tuberculin test could not be applied; but Nos. 41 and 44 received a third vaccinal injection from the 113th sub-culture, three weeks old. The health of all the animals remained perfect. In March 1915, four months later, No. 41 was accidentally strangled by its halter, and a post-mortem examination showed no evidence of tuberculosis. Material from the bronchial glands was injected into guinea-pigs, but failed to cause tuberculosis in these animals.

In August 1915, two years and eight (nine?) months from the commencement of the experiment, a German order made it compulsory to declare the number of cattle in the district, so that they could be requisitioned for the use of the army; and, to avoid this declaration, Calmette and his colleagues secretly slaughtered the animals, having in the first place tested them with tuberculin, with the following results:—

	C	V	V	C	V	V	C	V	V	C
Nos.	40	41	42	43	44	45	46	47	48	49
Tuberculin Test	+	(dead)	+	+	-	+	-	-	-	+
Febrile Reaction	2.9		2.5	2.6	0.0	1.7	0.3	0.7	0.8	1.7

These results showed that the cattle vaccinated three times, in 1912, 1913, and 1914 (Nos. 41 and 44), and No. 47, vaccinated twice, in 1912 and 1913, were still free from tuberculosis; whereas, of the three animals (Nos. 42, 45, and 48), vaccinated only once, in 1912, two (Nos. 42 and 45) had become infected, between the eighteenth and the thirty-second month of exposure to infection.

These results of the tuberculin test were confirmed by post-mortem examination, and inoculation of material from the animals into guinea-pigs.

Calmette concludes from these experiments that this method of vaccination confers on cattle immunity to tuberculosis, not only when virulent bovine bacilli are inoculated experimentally, but also when the vaccinated animals live in close association with manifestly tuberculous cattle. The duration of the immunity produced by the vaccination is about eighteen months, but it can be renewed by revaccination yearly.

Calmette hopes that the trial of his methods will be extended to a large number of animals, and will be followed during a cycle of years corresponding to the average duration of life of cattle. These and other

Vaccination of Cattle

tests are required before the practical value of the procedure can be precisely defined.

One may not conclude, then, with the lay press, that we have in this communication a solution of the tuberculosis problem, with all its dangers and difficulties. Calmette writes very cautiously, and is careful not to claim too much from his interesting, suggestive, and encouraging results.

The possibilities suggested by these experiments may be discussed, taking into consideration (1) the vaccinated cow; (2) its relationship to other unvaccinated cows; and (3) its relationship to man, into whose dietary its milk and flesh so largely enter. Then there is (4) the possible application of protective vaccination to man himself by the employment of a-virulent bovine or human strains of tubercle bacilli, a procedure which, though differing in details from Calmette's, has of course been already employed with more or less—chiefly less—success.

In the first place, the French experiments will have to be repeated and confirmed, and we may expect that bacteriologists all over the world will forthwith commence the necessary investigations. Doubtless, sub-cultures from the French strain will be made available for other workers, but these will themselves have to prove that virulent bovine bacilli can in every case be rendered a-virulent by Calmette's method. This will involve years of work. Calmette and Guérin had to grow their strain in successive sub-cultures during twelve and a half years.

(1) If Calmette and Guérin's results are confirmed—and this is highly probable—we shall be at liberty to assume that bovines, previously certified to be free from tuberculosis, by the tuberculin test, can with some certainty be protected from infection from bovine sources; but (3) the further assumption that the milk and flesh of such protected animals may be consumed by human beings without these incurring the danger of tuberculous infection requires some qualification. The danger would not be obviated if the protected animals (2) were kept in close association with other manifestly tuberculous cattle. Although themselves immune, they would inhale and ingest virulent bacilli from the diseased animals. Many of the ingested bacilli would be passed out of the body in the excreta, but others would enter the body, and circulate throughout it, being got rid of either by way of the bile—and so to the fæces—or by being excreted in the milk. Though modified, the danger to children of infection from the ingestion of such milk would still be present.

Looking at the cow solely as a source of food for man, one does not see much advantage in Calmette's method, when compared with that of Bang of Copenhagen, who takes the calf at birth from its

Theodore Shennan

tuberculous dam, and, by preventing it from receiving infection through its food or by association with diseased cattle, keeps it free from tuberculosis. Even supposing that Calmette and Guérin succeed in rendering their cattle immune from tuberculosis, their herds would have to be strictly isolated, so that they may not act as "carriers" of infective tubercle bacilli, received from outside sources—bovine, or even human.

(4) The variant of the tubercle bacillus which specially attacks bovines is now well recognised as an important factor also in the causation of tuberculosis in man, especially in the young. Frequently, it produces a localised tuberculosis which is recovered from, or readily removed by the surgeon; and I am of those who incline to regard a localised cervical gland tuberculosis, successfully combated by the patient, as more or less of a protection against later infection either from bovine or from human sources. It must be clearly understood, however, that many competent authorities decline to believe that this is so, and they can adduce strong support for their views. Recently (*Lancet*, London, 29th January 1921), the Society of Medical Officers of Health have thought it necessary, in view of the existing diversity of opinion, to place on record their opinion that there is an entire absence of proof that immunisation can be brought about by the ingestion of living tubercle bacilli in milk. I certainly agree that ingestion of living tubercle bacilli in milk is a serious danger, from which young children should be protected, and I have no sympathy with those who believe that the benefit to the child of drinking uncooked milk counterbalances the risk of infection by the living bovine bacilli which are so constantly introduced into the alimentary tract along with it.

Theoretically, it should be possible to protect the young from bovine infection by vaccination at stated intervals with a-virulent bovine tubercle bacilli, prepared by some method such as Calmette's, but the procedure would have to be proved free from danger even to the weakest infant, and the dosage adapted to the varying natural or acquired susceptibility of different individuals, and different families. The furnishing of these proofs would present a very difficult problem, perhaps not unsurmountable, seeing that one can argue to some extent from the results of animal inoculation.

If bovo-vaccination, conducted according to Calmette's method, proved free from danger when applied to the human subject, and successful in affording protection from infection from bovine sources, it might be expected also to protect to some degree at least against infection from human sources, but this is another debatable point. Definite proof of the specificity of the reaction following vaccination with any given organism is still wanting.

Vaccination of Cattle

Possibly it is frequently, if not always, a non-specific protein reaction. Calmette and Guérin's results, it must be admitted, favour the view that a specific reaction had been produced in the animals they experimented on. These authors have injected 44,000 a-virulent bovine bacilli into the human subject, intravenously, without the least result. This amount is not at all comparable with the 880 millions injected into the young cattle, in the experiments quoted, and in any case even untreated bovine bacilli are tolerated by most human adults, so that this result does not help us much in dealing with the problem.

From the point of view of the human subject, however, it is the human type of the tubercle bacillus that is accountable for the greater number, and the more important, of his tuberculous lesions, especially pulmonary tuberculosis. If strains of virulent human tubercle bacilli could be rendered a-virulent by treating them as Calmette and Guérin treated their bovine strain, they might be employed for protective vaccination, or even for therapeutic inoculation; but here again the difficulties of demonstrating the diminution of virulence would be even greater than in the case of the bovine bacillus, as experimental inoculation into human beings cannot even be considered, and dependence would have to be placed on the results of animal inoculation.

The above discussion has been provoked by the over-sanguine anticipations and hopes developed in the lay press when referring to Calmette's work. By following out a mode of attack such as has been outlined, the possibilities of the application to the human subject of Calmette and Guérin's results, not only for protective vaccination against tuberculosis, but also for the cure of the disease by therapeutic inoculation, may be, as the *Petit Journal* has it, "*immense*," but they are undoubtedly not immediate.

NEW BOOKS

Principles of Biochemistry. By T. BRAILSFORD ROBERTSON, Ph.D., D.Sc. Pp. xii + 633, with 49 illustrations. Philadelphia and New York: Lea & Febiger. 1920. Price \$8.

The work of Brailsford Robertson has long been recognised as being remarkable for the wide field which it has covered, by the originality and variety of the angles from which the problems are viewed, and by the unity of aim and purpose which permeates the whole. In the introductory chapter of the volume under review, the author explains his standpoint. "The investigator of Nature," he writes, "cannot afford to hamper himself by arbitrary definitions and delimitations of his field. When the need arises, he must be prepared to use the tools which the problem calls for, be they the tools of physics, chemistry, mathematics, anatomy, bacteriology, or pathology." This is the method which he follows in the present volume, and the result is necessarily of great interest and suggestiveness.

The ground which is covered is immense. After dealing fully with the physiological chemistry of the foodstuffs, he turns to the consideration of the properties of protoplasm—in particular to the mechanism of osmosis, and the principles of colloidal chemistry. He then dwells upon the chemical agencies which are engaged in correlating the physiological activities of the various units of the organised complex. The chapter dealing with examples of such chemical regulative agencies is of special interest to the pathologist and to the clinician. It contains a clear and lucid exposition of our knowledge regarding the physiological and pathological biochemistry of the ductless glands. In the next section he attacks what he considers to be the kernel of the problem—"the chemical processes which underlie and accompany life phenomena." The intermediate metabolisms of carbohydrates and fats are first discussed, and the description of diabetes presented is clear and concise. This is followed by a chapter, chiefly of a physico-chemical nature, dealing with the influence of temperature and light on vital processes, the photosyntheses of the vegetable kingdom, and the chemical mechanics of muscular contraction. A further chapter is devoted to the work of the American school upon the biochemistry of fertilisation and cell division. The next chapter is to the reviewer the most interesting of all. It deals with the mechanism of the growth process. In this the author dwells upon the fact that the simplest types of growth processes are analogous from a mathematical point of view with the processes of an autocatalysed monomolecular reaction. There

New Books

has of recent years been a strong tendency to force the nomenclature of chemical dynamics upon many types of vital phenomena. That all of these are examples of *mass action* is granted. But it seems unnecessary to designate, for example, an unoffending parent by the term autocatalyst, although if one presses the chemical analogy there is no doubt that he operates as such. The chapter is full of interest both from the general point of view and from the particular; the linkage with the biochemistry and pathology of the ductless glands is thoroughly up to date and full of suggestiveness. This interesting section closes with a chapter on memory and sleep. The final sections deal with the products of tissue activity and the energy balance of the organism.

Enough has been said to indicate the scope of this excellent and suggestive treatise. Both for the knowledge which it contains and for its method of attack it should be in the hands of every biological investigator. The author has set himself a hard task and he has succeeded. The line of thought is unbroken from start to finish. He does not present a mass of facts but a science. Valuable bibliographies are appended to each chapter.

The Diseases of the New Born. By Dr AUGUST RITTER VON REUSS. Translation revised by John D. Rolleston, M.D., B.Ch., M.A. (Oxon). Pp. xii+626, with 90 illustrations. London: John Bale, Sons, & Danielsson, Ltd. Price 52s. 6d. net.

The author, on general grounds, lays down the first two or three weeks as the "new born" period, when the vital processes are still under the influence of those violent changes involved in the abrupt transition from intra to extra uterine life, and when a number of diseases are met with that are peculiar to this period, or when the diseases common to all periods of infancy are met with in modified forms. He draws attention to the fact that this is a period fraught with danger to the child for the reason that the latter is too often looked upon by the obstetrician as outside his special province, or because its ailments are little understood by him, while the pediatrician has little opportunity to acquire a thorough knowledge of the physiology and pathology of the newly born infant. In short, and not to put too fine a point upon it, the newly born infant is nobody's business in particular. The author, however, has had singular opportunities for acquiring experience of the conditions, normal and abnormal, peculiar to this danger period, being Director since 1911 of the New Born Department in the First University Women's Clinic, Vienna, established by Schauta, a clinic within a clinic, and an innovation, surely, that is much overdue in the Maternity Hospitals of this country.

New Books

The book is divided into nine parts, and includes amongst others, sections on Physiology, Feeding, The Premature Child, Birth Injuries, Acute and Chronic Infections, Diseases of the Individual Organs and Systems, Sepsis, etc. The section dealing with breast feeding is excellent, but that concerned with artificial feeding is much too brief, running only to some four pages. The section on the premature child is good, though the same objection largely applies as regards the directions for feeding. The various methods of combating hypothermia are discussed in detail, and the various forms of *couvenses* described, though less fully than one would wish. One is impressed on reading this section with the care and knowledge bestowed on the premature infant abroad, especially in France and Germany, compared with the haphazard methods still employed in our own country—too often with unfortunate results. As the author rightly points out, "Spartan principles evolved from the consideration that it is not worth while to permit the survival of the unfit do not apply in any way to premature infants. If it is possible to keep a premature child alive through the dangers of the first period of life, provided that it comes from healthy parents, it may develop into a human being normal in every respect."

It is almost incredible that even in the *large* Maternity Institutions of this country the *couvense* is practically unknown.

A useful bibliography is appended. The book can be cordially recommended to those wishing the presentation in a convenient form of the German and Austrian teaching upon the subject of which it treats, and should find a place on the bookshelves of all obstetricians and pediatricists.

Exophthalmic Goitre and its Non-Surgical Treatment. By ISRAEL BRAM, M.D. Pp. 438. London: Henry Kimpton. 1921. Price 32s. net.

The treatment of exophthalmic goitre is so often a matter of the greatest difficulty that a treatise of this size on the purely medical therapeutics of the disease attracts by its very title. After reading it, however, a certain sense of disappointment is aroused, for among the multiplicity of remedies ransacked from the vast literature of the disease, how few have really stood the test of experience. Rather more than half the book deals with symptomatology, largely a compilation from other sources. The various physical, pharmacological, and psychological lines of treatment are described, and at the end of it all the reader is not very much wiser than before. Most of the methods of treatment described are not new, and however useful Dr Bram's book may be in showing that operation is not the only remedy for exophthalmic goitre, we doubt whether those who believe

New Books

that by persevering and prolonged rest they get fairly good results in the disease will find much to alter or add after reading Dr Bram's book.

The Basis of Psychiatry. By A. C. BUCKLEY. Pp. 447, with 79 illustrations. Philadelphia and London: J. B. Lippincott. 1921. Price 30s. net.

This is a text-book of psychiatry intended primarily for the use of students. The first section gives a clear account of the development of the cerebrum and the receptive apparatus, and then passes on to describe the psychological processes in a more or less traditional manner. Its chief interest lies in the author's approach to the problem of the nature of the psychoses along biological lines. Here and there one may be doubtful how far he is prepared to travel with the extremists of the American school of "behaviouristic psychology," but his predilection for that mode of thought is generally quite apparent. Witness his approval of Pawlow's dictum that psychic activity "is nothing but an endless chain of reflexes, that is, pre-determined responses to environment." So also, his classification of mental diseases is based on the differentiation of distinct "reaction types," and his conception of their etiology gives great prominence to somatic disorders. Whatever the defects of this view of human activity (and its limitations are illustrated in the book before us), its beneficial influence on the general trend of psychology in relation to mental diseases is beyond question. To those in particular who need a corrective for the extravagances of the neo-Freudians, this volume may confidently be recommended.

The second section gives an account of the clinical features of the various psychoses and the psychoneuroses. In the main the treatment of these follows the teaching of Kraepelin. The volume has a good glossary of technical terms which the student will find useful.

Manic-Depressive Insanity and Paranoia. By Professor EMIL KRAEPELIN; translated by R. Mary Barclay, M.A., M.B.; edited by Professor George M. Robertson, M.D., F.R.C.P., Edinburgh. Pp. xv + 280, with 53 illustrations. Edinburgh: E. & S. Livingstone. 1921. Price 21s. net.

To English-speaking alienists the appearance of this translation of Professor Kraepelin's work on manic-depressive insanity and paranoia will be welcome. The soundness of Kraepelin's conception of manic-depressive insanity is now practically unquestioned; and this volume takes us along the paths which led him to this very comprehensive view of what was formerly rather a chaotic aspect of psychiatry. Adhering to his usual practice, Kraepelin describes

New Books

seriatim the various symptoms of this disorder rather than concrete cases. This method, while hardly suited to the medical student, is an admirable one for those more advanced in psychiatry, and encourages acute and detailed clinical observation.

The vexed question of the mixed states has been treated with great cleverness, but as Professor Robertson puts it in his preface, Kraepelin's conclusions on this matter are still open to doubt. The section on paranoia is admirable. In it Kraepelin deals exclusively with what is called "true" paranoia, giving us an addition to our knowledge of this subject which is of such value that it may fairly be said to form the most exhaustive and scientific discussion in our language of this comparatively rare disorder.

Dr Barclay is to be congratulated upon an excellent translation, and our thanks are due to Professor Robertson for having brought out this volume and its predecessor on *Dementia Præcox*. The book can be strongly recommended to all interested in clinical psychology, more especially to those studying for advanced degrees in the subject.

Diseases of the Skin. By I. M. H. MACLEOD, M.A., M.D., F.R.C.P.
Pp. xx + 1307, with 458 illustrations. London: H. K. Lewis
& Co., Ltd. 1920. Price £3, 10s. net.

This text-book, as the author states in the preface, is the outcome of many years of work in laboratory and hospital. The subjects are thoroughly dealt with, the descriptions of diseases are clear and well expressed, and where the cause of any condition is doubtful the author does not hesitate to express his own views, although the opinions and theories of others are also fully stated. Treatment is fully detailed and many alternative methods are mentioned.

The coloured illustrations are disappointing in some instances, but the photographs of diseases, microscopic sections of skin, and drawings, are almost without exception excellent. The majority are from the author's own cases, but he has wisely borrowed from his colleagues many illustrations which add to the value of the book. The section on syphilis is concise yet comprehensive. There is also a section devoted to burns, the later stages of which often require considerable dermatological skill in their treatment. The latter part of the book is devoted to tropical skin diseases, but it is doubtful if it would not have been better to describe these diseases each under its own group.

The book is too large for students, but we can recommend it with every confidence to the practitioner as a thoroughly practical and comprehensive guide; the treatment is so fully described that he cannot fail to get helpful suggestions.

Foreign Books

Advanced Lessons in Practical Physiology for Students of Medicine.

By RUSSELL BURTON-OPITZ, S.M., M.D., Ph.D. Pp. 238, with 123 illustrations. Philadelphia & London: W. B. Saunders Company. 1920. Price 18s.

A useful and very complete guide to the student of practical physiology, who will later proceed to clinical work, as the medical application of clinical facts is never lost sight of. Occasionally accuracy and detail of technique seem rather unnecessarily sacrificed, which may be of little importance in a class working under ample and efficient instruction as to the author's intention, but nevertheless lessens the more general value of the book.

The work is arranged as a course of fifty lessons of three hours' duration, with thirty suggested one-hour demonstrations, and the book is interleaved at the end of each lesson. Throughout the experiments are so presented as to encourage individual interest, and logical deduction, and should be a valuable basis of training in observation and technique.

FOREIGN BOOKS

Nouveau Traité de Médecine.—Publée sous la direction de MM. les Professeurs G. H. ROGER, F. WIDAL, and P. T. Teissier. Fascicule premier. Maladies Infectieuses. Pp. xviii + 482. Paris: Masson et Cie. 1920. Price 35 fr. net.

This new *Traité de Médecine* is conceived on ambitious plan. It is to consist of twenty-one volumes, and is designed as a worthy successor to the classical treatise edited by Charcot, Bouchard, and Bressaud, which on its first appearance in 1891 secured a foremost place among works of its kind. In 1912 Bouchard contemplated a third edition of the work, and enlisted the services of his pupils, Roger, Widal, and Teissier, on the new venture. They began the task, and the first volume was on the point of appearing when the war broke out. Bouchard died in 1915, but the impulse he gave has lasted, though in view of the hiatus 1914-18, a totally new treatise is now planned instead of a revision of the old one. The first volume of the *Nouveau Traité* is a handsome and beautifully printed volume. The paper, typography, and proof-correcting are back to the pre-war standard, a thing which cannot yet be said of many of the books of 1920-21. There are a number of illustrations in the text, and three plates in colour, admirably reproduced.

The volume opens with an account of the general pathology of infection by Roger, who also writes the articles on "Streptococcus Infections and Erysipelas." In these, as indeed in all the other articles, the characteristics of French medicine are apparent. The

Foreign Books

lucidity and precision with which symptoms are described and clinical types differentiated must be studied in the text to be appreciated. Perhaps the most important article in the book is that on pneumococcus infections by MM. Menetrier and Stevenin, in which the work of American and British researchers on the types of pneumococci is fully recognised. The classical manifestations are described under the heads of septicaemia, with a short description of the principal local visceral infections. Then comes a long account of pneumonia, extending to ninety pages, and including a very well illustrated description of the morbid anatomy of the lung; next comes the pathological physiology, and next the symptoms, complications, and so on. The whole constitutes a very valuable and thoroughly up-to-date monograph on the disease.

The other infections dealt with in this volume are the staphylococcus, Pfeiffer's bacillus, Friedlander's bacillus, *B. proteus*, meningococcus and the gonococcus. Influenza, however, is deferred to a later volume. The whole of the papers appear to us to be of the very highest standard, as indeed was to be expected in a system of medicine of this class.

The general plan of the work is as follows:—Infectious Diseases, 3 parts; Infectious and Parasitic Diseases, 2 parts; Intoxications, 1 part; Diseases due to Lack of Vitamines, 1 part; Diseases of Endocrine Glands, 1 part; Hæmopoietic Organs, 1 part; Circulation, 1 part; Respiration, 2 parts; Digestive Organs, 4 parts; Renal Disease, 1 part; Nervous System, 3 parts; Bones, etc., 1 part. The publishers promise the complete work within two years. The Editors have secured the services of 128 Collaborators, most of whom represent the principal medical schools in France. It is interesting, however, as indicating the widely-spread influence of French medicine, to note among the names physicians working in Buenos Ayres, Rio de Janeiro, Montreal, Beyrout, Alexandria, Prague, Warsaw, Copenhagen, Bucharest, Tunis, Turin, Lund, Cagliari, and Harvard. If, as we doubt not, the promise of this first fasciculus is fulfilled, the *Nouveau Traité de Médecine* will take a front place among other classical systems of medicine, and will add lustre to French medicine.

Etude Microscopique de l'œil vivant, par MM. le Pr. Gallemaerts et le Dr Kleefeld (Paris: Librairie Octave Doin, 1920), is a record of observations carried out by the Professor of Ophthalmology in the University of Brussels, and one of his assistants, with the Czapski binocular corneal microscope, with which can be obtained a magnified stereoscopic view of the parts of the living eye that are visible without the aid of the ophthalmoscope. The authors give a description, illustrated by plates, of their observations in normal and pathological cases. Their findings show that a great deal can be learned by expert users of Czapski's instrument.

NEW EDITIONS

The Clinical Study and Treatment of Sick Children. By JOHN THOMSON, M.D., F.R.C.P.E. Third Edition. Pp. xxxii + 877. Edinburgh: Oliver & Boyd. 1921. Price 32s. 6d.

The appearance of the third edition of Dr Thomson's book is an event of some importance in the eyes of many who have awaited it with some impatience as overdue. Even a hasty survey, however, shows that the delay has had its compensations in the very thorough and exhaustive revision which the book has undergone. From a comparatively small beginning in 1898, when it consisted of rather more than 300 pages, it has grown to the dimensions of a respectably sized text-book, and correspondingly to the increased scope of the work, the title has been altered from "The Clinical Examination" to "The Clinical Study" of sick children. What is more to the point is, that if it is thrice as big, it is more than thrice as good. An epigrammatist once defined great wisdom as "knowing something about everything and everything about something," and the definition applies very exactly to this book. It would be difficult or impossible to think of any disease or symptom of disease in childhood, however rare, about which Dr Thomson has not something to say, and there are certain subjects which he has made peculiarly his own, such as pyloric stenosis, cretinism, and others, about which all, or almost all, that need be said is said. Apart from the accuracy and originality of the author's observations, and the wide clinical experience which they display, it is this encyclopædic character which gives this book a very unique position in British medical literature, and it is largely through the addition in each successive edition of fresh observations and descriptions of the less common manifestation of disease that the present volume is so much larger and more important than its predecessors.

The revision, as has been said, has been very extensive and thorough; here we have practically a new book, and it is impossible to do more in a limited space than glance at some of the principal new features. Modern teaching on the relation of diet to dental caries is dealt with at considerable length. The chapters on infant feeding have been much added to, and a new chapter on the food disorders of infancy finds a place here. This is a very clear and concise account of a difficult subject. A good deal of new matter has been added to the chapter on rickets, especially as regards the etiology of the disease. Coeliac disease is dealt with at considerable length. The section on disease of the liver is very interesting, and has been enriched by an admirable description from the clinical standpoint of subacute atrophy

New Editions

of the liver, a condition the importance of which in childhood is insufficiently recognised. The chapter on skin diseases has also been much amplified. Notable new features are the chapters on pyrexia, and on acetonæmia, the latter especially being an admirable reasoned summary of present knowledge of an obscure subject, in which the clinical aspects of acidosis are emphasised. Spasmophilia now has a chapter to itself, and a great deal of new material has been incorporated with the sections dealing with functional nervous disorders. Encephalitis lethargica and poliomyelitis are discussed together in a chapter by themselves. As in previous editions, the illustrations are an outstanding feature, and Dr Thomson has spared no pains to secure good and characteristic photographs of disease. This is especially the case, perhaps, in the later pages which treat of disease of the nervous system and certain rare abnormalities. Particularly striking and instructive are the series illustrative of Thomsen's disease, and those of congenital defects of the abdominal muscles, while those of the various defects of growth, of osteogenesis imperfecta, of oxycephaly, to name only a few, are graphic and worth pages of description.

Several new appendices have been added amongst which the "Note on Anaphylaxis" is especially to be mentioned. The explanation of the value of chloral in certain possibly anaphylactic conditions is a hint well worthy of being followed up.

The book is of quite outstanding merit, and is certainly the most original and important work on medicine which has been produced in Edinburgh in recent years, and will deservedly enhance the already high reputation of its author. The publishers also deserve credit for the way the book has been produced. The type-setting, quality of paper, and general get-up are reminiscent of pre-war conditions.

A Text-Book of Pathology. By W. G. MACCALLUM. Second Edition. Pp. xv + 1155, with 575 illustrations. Philadelphia and London: W. B. Saunders Company. 1920. Price 45s.

When this text-book first appeared four years ago, it was at once recognised to be one of the most trustworthy expositions of the subject, and this new edition bears evidence of careful revisal. The author's method is unique, for the scope of the work does not include the presentation of all the facts of general and special pathology, but the book is planned to discuss disease as far as possible upon the basis of etiology, while the very complete index is so arranged as to facilitate reference to lesions according to their anatomical distribution. The opening chapters are devoted to general working principles, *e.g.*, disturbances in the circulation and in metabolism, while the rest of the book deals with various types

New Editions

of injury and their immediate and remote effects—the chapter on tumours being kept distinct from this general method of treatment. The author has kept in view, throughout, the correlation of clinical medicine and pathology by constant reference to symptoms and to disturbance of function, and of chemical interchange in the course of disease. The book must, therefore, make a special appeal to students of the Edinburgh School who have been taught in the pathology department to look upon clinical medicine and pathology as the same thing viewed from different angles, and whose work in the morbid anatomy class is an attempt to offer a pathological explanation of symptoms.

In this new edition important additions have been made to the sections dealing with shock, influenza, meningococcal and other infections, while among important new sections are those relating to acid-base equilibrium, hydrocephalus and immunity in tuberculosis.

It can scarcely be regarded as an ideal text-book for those preparing for examinations, but the reviewer knows from experience the enthusiasm which it has created in the minds of many students, and no student possessing such a volume will wish to be done with pathology when he has passed his examination. The reviewer also acknowledges, with gratitude, the constant stimulus and help it gave to his own teaching, and is greatly impressed with the lucidity and adequacy of the individual chapters, and the wealth and beauty of the illustrations which are taken mainly from original drawings. The only adverse criticism that might be offered is that there is a certain want of proportion in the treatment of one or two of the subjects, but this is almost inevitable in a book written not on stereotyped lines. Valuable bibliographies are attached to each chapter: these, however, seldom refer to British work.

Text-book of Embryology. By CHARLES WILLIAM PRENTISS. Revised and rewritten by Leslie Brainerd Arey. Third Edition. Pp. viii + 412, with 388 illustrations. W. B. Saunders Company. 1920. Price £1, 7s. 6d. net.

The importance of a knowledge of embryology for a correct understanding of many of the problems of anatomy, surgery, and pathology is now recognised.

This book combines brief descriptions of vertebrate embryos with an account of human embryology, and is specially adapted for the use of the medical student. Chick, pig, and human embryos have been chosen as representing the differing degrees of development in the importance of the rôle of the chorion. It is divided into thirteen chapters, dealing in turn with the germ cells, cleavage, chick, pig and human embryos, the development of the different tissue

New Editions

systems, histogenesis, and the morphogenesis of the skeletal and muscular, the central and peripheral nervous systems. The subject-matter in each section is clearly expressed and well illustrated, but the description and the illustrations representing cleavage are specially instructive. The wealth of illustrations is a special feature of the book, and the figures, giving reconstructions of embryos of various sizes, show, as well as could any descriptions, the changes which lead to the adult form. The author confesses his inability to find a satisfactory English equivalent for the German word *Anlage*, which is in consequence used throughout the book to describe any cell or aggregation of cells destined to form any distinct part or organ of the embryo.

There is little to criticise adversely, but if a single such criticism may be made it is that the author of a book of this size, which is obviously the outcome of many years' practical experience of teaching, should subscribe to views on certain debatable points without giving due importance to recent work. In the section dealing, for example, with the germ cells, no reference is made to such an important piece of embryological work as that of Beard on the morphological continuity of the germ cells; in that dealing with the origin of the erythrocytes, the text and figure point to the extrusion of the nucleus of the erythroblast; in that relating to the development of the liver, neither description nor illustration give an adequate conception of the unit of structure of the liver lobule; and, finally, the author subscribes to the view that nerve fibres are outgrowths of the neuroblasts. No references to literature, except a brief list in the opening chapter, are given.

Internal Medicine. By JAMES C. WILSON, M.D., and NATHANIEL POTTER, M.D. Fifth Edition. Three Vols. Pp. xxiv + 2167, with 441 illustrations; with Desk Index, pp. 170. Philadelphia & London: J. B. Lippincott Company. 1919. Price £4, 10s. net.

The first edition of this comprehensive work appeared in 1909. The fifth edition maintains the same high standard as its predecessors and much new material has been added.

The first two volumes are devoted to diagnosis, the third volume to treatment, and a small fourth volume provides a desk index which will facilitate reference.

A great mass of detailed information is rendered available and easily accessible, regarding the work done in recent years in connection with methods of diagnosis and their practical application, and with modern therapy. Though the original arrangement of the work has been adhered to, careful revision has been carried out and several

Books Received

new sections have been added. Professor Robinson has written fully on graphic methods in the study of diseases of the heart, and a valuable section has been contributed by Dr Rehfuß upon the newer gastro-enterological methods of diagnosis—while Dr Corson White has written a useful section on serology.

In the volume on treatment, the therapy of the various systems is first taken up, followed by that of diseases of metabolism, of acute infectious diseases, and of neurasthenia. The editor has also added a new and comprehensive chapter on the general treatment of syphilis.

This work can be recommended with confidence, both on account of the subject-matter and the manner of its presentation. The authors are to be congratulated on having placed before the physician a comprehensive account of modern diagnostic and therapeutic procedure.

BOOKS RECEIVED

BAKER, T. THORNE. Radiographic Technique	(Constable & Co., Ltd.)	15s.
BANDLER, SAMUEL WYLLIS. The Endocrines	(W. B. Saunders Company)	35s.
BAYLISS, L. MADDOCK. Principles of General Physiology. Third Edition	(Longmans, Green & Co.)	28s.
BEATTIE, J. MARTIN, and W. E. CARNEGIE DICKSON. A Text-Book of General Pathology. Second Edition	(Wm. Heinemann (Medical Books), Ltd.)	31s. 6d.
BROCKBANK, E. M., and ALBERT RAMSBOTTOM. The Clinical Examination of Diseases of the Lungs	(H. K. Lewis & Co., Ltd.)	4s. 6d.
BURNET, J. Materia Medica	(J. & A. Churchill)	4s. 6d.
CARMAN, RUSSELL D. The Roentgen Diagnosis of the Diseases of the Alimentary Canal. Second Edition	(W. B. Saunders Company)	42s.
CLUBBE, CHARLES P. B. The Diagnosis and Treatment of Intussusception. Second Edition	(Henry Frowde and Hodder & Stoughton)	7s. 6d.
CRILE, GEORGE W. The Physical Interpretation of Shock, Exhaustion, and Restoration	(Henry Frowde and Hodder & Stoughton)	25s.
CUMBERBATCH, ELKIN P. Diathermy: its Production and Uses in Medicine and Surgery	(Wm. Heinemann (Medical Books), Ltd.)	21s.
CUMBERBATCH, ELKIN P. Essentials of Medical Electricity. Fifth Edition	(Henry Kimpton)	10s. 6d.
DAVIS, HALDIN. Skin Diseases in General Practice: their Recognition and Treatment	(Henry Frowde and Hodder & Stoughton)	25s.
EMERY, W. D'ESTE. Clinical Bacteriology and Hæmatology for Practitioners. Sixth Edition	(H. K. Lewis & Co., Ltd.)	15s.
FERGUSON, JOHN. Thyrea and other Sonnets. Seventh Edition	(Andrew Melrose, Ltd.)	1s. 6d.
FISCHER, MARTIN H. Œdema and Nephritis. Third Edition	(Chapman & Hall)	55s.
FULLER, HENRY C. The Chemistry and Analysis of Drugs and Medicines	(Chapman & Hall)	55s.
FULLER, HENRY C. The Qualitative Analysis of Medicinal Preparations. Second Edition	(Chapman & Hall)	12s. 6d.
HIGHMAN, WALTER JAMES. Dermatology: the Essentials of Cutaneous Medicine	(Macmillan & Co., Ltd.)	32s.

Books Received

- HUMPHRIS, FRANCIS HOWARD. *Electro-Therapeutics for Practitioners*. Second Edition. (*Henry Frowde and Hodder & Stoughton*) 21s.
- JELLETT, HENRY, and DAVID G. MADILL. *A Manual of Midwifery*. Third Edition. (*Baillière, Tindall & Cox*) 42s.
- JONES, SIR ROBERT, Edited by. *Orthopædic Surgery of Injuries*, by Various Authors. In Two Volumes. per set, £4, 4s.
- JOHNS HOPKINS HOSPITAL REPORTS. Vol. XX., Fasc I. II. and III. (*The Johns Hopkins Press*)
- MACKENZIE, SIR JAMES. *Symptoms and their Interpretation*. Fourth Edition. (*Shaw & Son*)
- McMECHAN, F. H., Edited by. *The American Year Book of Anæsthesia and Analgesia, 1917-1918*. Vol. II. (*Surgery Publishing Company*)
- MAY, PERCY. *The Chemistry of Synthetic Drugs*. Third Edition (*Longmans, Green & Co.*) 12s. 6d.
- MAYNARD, F. P. *Manual of Ophthalmic Operations*. Second Edition (*E. & S. Livingstone*) 21s.
- MAYNARD, F. P. *Manual of Ophthalmic Practice*. (*E. & S. Livingstone*) 25s.
- MELLISH, Mrs M. H., Edited by. *Collected Papers of the Mayo Clinic*. Vol. XI. 1919. (*W. B. Saunders Company*) 60s.
- RANSON, STEPHEN WALTER. *The Anatomy of the Nervous System* (*W. B. Saunders Company*) 32s. 6d.
- REHBERGER, GEORGE H., Edited by. *Lippincott's Quick Reference Book for Medicine and Surgery*. (*J. B. Lippincott Company*) 63s.
- ROBINSON, G. DRUMMOND. *Atlas of Normal Labour* (*Wm. Heinemann (Medical Books), Ltd.*) 25s.
- THOMSON, J. ARTHUR. *Outlines of Zoology*. Seventh Edition (*Henry Frowde and Hodder & Stoughton*) 18s.
- TRANSACTIONS OF THE AMERICAN PEDIATRIC SOCIETY. Vol. XXXII. 1921.
- WORTH, CLAUD. *Squint: its Causes, Pathology, and Treatment*. Fifth Edition. (*Baillière, Tindall & Cox*) 12s. 6d.

ROYAL COLLEGE OF SURGEONS OF EDINBURGH.

Dental Examination Passes.

At the recent Dental Examinations just concluded the following candidates passed the Final Examination and were granted the Diploma L.D.S., R.C.S. (Edin.):—Donald Skinner, Inverness; Thomas G. Doig Edinburgh; George I. Alexander, Edinburgh; Alan W. Hart, Edinburgh; Wilfred Rosenblatt, Cape Town; Stanley Robertson, M.B., Ch.B. (Glasg.), Dumbarton; Sidney Osborn, M.B., Ch.B. (Edin.), Southampton; Albert E. Muriset, Edinburgh; Nathan Israel, South Africa; and James Stewart Durward, L.R.C.P. & S.E., etc., Edinburgh.

ERRATA.

On page 247: for "A Case of Primary Brachial Neuritis treated by Stretching of the Cervical Plexus" read "A Case of Primary Brachial Neuritis treated by Stretching of the *Brachial* Plexus."

On page 248, line 35: for "cervical" read "brachial."

Edinburgh Medical Journal

June 1921

EDITORIAL NOTES

Dr HENRY BARNES died in his home in Carlisle on 12th April, and by his death there passed away one who had brought honour to his profession, and had done great and enduring work for the county in which he was born and for the community in which he had lived. In the early sixties he was a distinguished and popular student in Edinburgh, where he graduated with honours in 1864, and two years later he settled in Carlisle. There the name of "Dr Barnes" was already well known, for his uncle, Dr Thomas Barnes, was Physician to the Cumberland Infirmary and the Fever Hospital, and had a merited reputation to which his nephew in his own case was to add high estimation and brilliancy. After five years' service as Physician to the Cumberland Dispensary, he succeeded his uncle as Physician to the Fever Hospital, where he did excellent work, and in 1873, again following in the same footsteps, he began his official connection with the Cumberland Infirmary. For thirty years he acted as physician in its wards, carrying out his onerous duties with notable skill and success—a success due in no small measure to his unvaried sympathy with the sufferers. While thus discharging a public service, his private practice was steadily growing, and ere he withdrew from the one and retired from the other, he had a widely spread and influential clientele, and his services were in demand as a consultant. I believe—and I knew him as a fellow-student and a hospital colleague—that one of his chief purposes in life was to obtain distinction and usefulness in his profession, and this aspiration had come to him fully, for during these thirty years of professional activity he had been the master of many lives, and the result of his skill had not been unremembered as his future influence shows. On his retirement from the medical work of the hospital in 1903, he became Chairman of the Committee of Management, and in this position set himself with characteristic energy and ardour to an increased development of the Institution, in the course of which he displayed extraordinary administrative and organising powers. By his eminent character and reputation, and through his powers of persuasion—by tongue and by pen—a sum of £30,000 was raised, and by means of this there was added to the building a handsome wing which deservedly bears the name of Henry Barnes, and carries with it the

Editorial Notes

assurance that as an honoured name it will not be forgotten. His interests and energies were too great to find contentment in one object, and he was a hard-working and effective member of the British Medical Association, for which he did much in the Border Counties, and it was largely due to his efforts that the branch was first formed. It was his fostering care as its Secretary and President which laid the foundation upon which its present greatness rests, and possibly in recognition of this success the Annual Meeting of the Association was held in Carlisle in 1896. Barnes then occupied the Presidential Chair, and in the ability of the address which he delivered, and in the marked success which attended the gathering, he demonstrated his varied powers.

The Home for Incurables, the Silloth Convalescent Institution, and the Red Cross all shared in his interest, and in his altruistic labours, and for his distinguished services in connection with the latter movement during the war, he was rewarded by being created an O.B.E. Like very many busy men he was happy in possessing a hobby, and in antiquarian research—bearing especially on the period of the Roman Occupation—he found pleasure and instruction. Last year he was elected as President of the Cumberland Infirmary—in succession to the late Bishop Diggle—and this honour was highly appreciated by him, for it is a position which has always been held by men of mark, and his gratification was greatly increased when the Medical Staff, in recognition of his services to the Institution, and as an indication of their approbation and respect presented him with a silver inkstand. In thanking the Staff for their gift, he spoke of their obligation to make it their constant care to uphold the usefulness and the noteworthy traditions of the hospital, because, as he pleaded, “The night cometh when no man can work.” The force of these words his death has emphasised, though he was one of these rare men to whom it is granted that they should be able to bring forth fruit in good works even in old age, and to whom there is no twilight in their day of life, for he passed quickly, ripe in years and rich in achievement, to higher service.

If it be that a man walks worthily in the world when he faithfully performs the duties of his calling, and that unselfish service is one of the most excellent things on earth, then Henry Barnes was truly worthy, for his personality was unified in duty well performed and in the pursuit of many noble ends.—J. A. MACDOUGALL.

EVEN among those whose primary concern is the health of the people it does not seem to be as yet generally realised that in quite a number of respects the year 1920 was a record year in Scotland. The Registrar-General's Report for the last quarter of that year points out that in

1920: A Year of
Statistical Records.

Editorial Notes

many ways the last twelve months of the decade showed unprecedented figures. His full report for the whole of 1920 is yet to be issued; but the preliminary statement announces many surprising and, almost all of them, satisfactory facts.

The completed, revised report for the year 1920 will be the Sixty-sixth Annual Report. Thus we are able to review practically two-thirds of a century. In no less than nine features is the year 1920 a record year.

(1) The marriage-rate of the year, 9.6 per 1000, is the highest recorded. This means that every fifty-third person in the community (including children and old people and not merely those of marriageable age) got married in 1920. Only one year approximates to 1920 in this respect since registration began, namely, the year 1919.

(2) The actual number of marriages registered in Scotland in 1920 (46,839) is the highest on record.

(3) The actual number of births, similarly, is the highest ever registered. It is true that there was a higher birth-rate in 1906, but the population was less at that time. The births registered in Scotland in 1920 were 136,535, against 106,268 in 1919—a rise of over 28 per cent. The contrast with 1917 (the year of lowest birth-rate in Scotland since 1853), when there were only 97,441 births, shows in 1920 a rise of over 40 per cent. This feature of special fertility that distinguishes the year 1920 is due to the extraordinarily high number of births in the first half of the year: the latter half, as the Registrar-General points out, shows no marked excess over pre-war years.

(4) Still more significant is the remarkably low death-rate of 14 per 1000—the lowest ever reached. Considering together the figures given in (3) and (4), we find that the excess of births over deaths for Scotland in 1920 was 68,356: this is a greater difference than in any year since registration began. The next best year in this respect is 1896 with 58,495 of difference—over 14 per cent. less than in 1920.

(5) Perhaps most significant of all is the low rate of infantile mortality in Scotland in 1920—a rate of 92 deaths of infants under one year of age per 1000 registered births. This is the lowest infant mortality rate ever recorded in Scotland, and shows a marked fall from previous years. Satisfactory though it be, we must consider it in light of the peculiar weather conditions of the year.

(6) The deaths from tuberculous disease (all forms) reached the lowest rate yet recorded (124 per 100,000)—a fall of almost 4 per cent. from the previous year.

(7) The death-rate from phthisis fell to 86 per 100,000: again the lowest on record and a fall of fully 2 per cent.

Editorial Notes

(8) The deaths from whooping-cough recorded in 1920 were fewer than in any previous year. This, however satisfactory, is less likely to be due to abiding causes than the other records enumerated.

(9) Only one of the nine "records" is unsatisfactory. The deaths due to malignant disease were more numerous in 1920 than in any previous year. They were fully one-third more in number than the deaths ascribed to phthisis.

Further scrutiny of the Registrar-General's Report for the last quarter of 1920 (from which the figures above quoted have been taken) reveals a number of interesting and suggestive facts.

The urban phthisis death-rate for the year varies strikingly from town to town—from 112 per 100,000 in Leith to 67 in Motherwell.

To puerperal sepsis are ascribed 242 deaths in the year 1920—surely not a creditable number.

Among the deaths registered in 1920, only 96 were due to enteric fever. In 1875, 1625 deaths were ascribed to this cause; and every year from 1865 to 1882 the annual number invariably exceeded 1000. But—

In 1895 the number was 730

„ 1900	„	„	644
„ 1905	„	„	373
„ 1910	„	„	264
„ 1915	„	„	171
„ 1920	„	„	96

With uniform steadiness the rate of fall has been maintained.

Sixteen deaths were due to typhus fever in 1920; and 152 to smallpox.

The deaths from measles numbered 816—fewer than in any year since 1894.

The illegitimate births registered in 1920 numbered 10,207, or 7.5 per cent. of the whole. The annual illegitimate birth-rate since the period before the war shows until 1918 a steady rise.

In 1914 illegitimate births made 6.64 per cent of the whole.

„ 1915	„	„	6.90	„	„
„ 1916	„	„	7.10	„	„
„ 1917	„	„	7.49	„	„
„ 1918	„	„	7.97	„	„
„ 1919	„	„	7.93	„	„
„ 1920	„	„	7.50	„	„

Editorial Notes

THE second Annual Meeting of this Association was held in Edinburgh on 5th, 6th, and 7th May.

The Association of Surgeons of Great Britain and Ireland. Representatives from nearly all the British Schools were present to the number of about 120. Communications were made on various subjects of current surgical interest, and discussions followed. Clinical demonstrations were given in the Royal Infirmary and Royal Hospital for Sick Children, and selected operations were performed by the surgeons of these hospitals. A most instructive collection of specimens, microscopic preparations, illustrations, and radiograms illustrative of a variety of subjects of present-day interest to surgeons, was exhibited in the Royal Infirmary, and the members of the Association visited the museum of the Royal College of Surgeons, where the Conservator demonstrated a unique collection illustrative of surgical craniology. Demonstrations were also given in the Physiology Department and elsewhere. On Friday evening the Association dined in the hall of the Royal College of Surgeons.

OF sixty-one candidates who entered for the examination in April, the following passed the Final Examination and **Triple Qualification Passes.** were admitted L.R.C.P.E., L.R.C.S.E., L.R.F.P. & S.G.:—Helen Worthington, Cincinnati, Ohio; Daniel R. Cilliers, Aberdeen, Cape Province; Norman M. D. Fox, Cootamundra; D. J. H. Ferdinando, Ceylon; John Murray, North Berwick; A. J. Vakil, India; Arnold A. Hamilton, Coulter, Lanarkshire; Alan B. Taylor, New York; Reginald E. Hopton, Cirencester; James I. Coventry, Glasgow; Ronald G. Clouston, Coupar-Angus; Peter F. Fairley, Hamilton; S. Denis de Vos, Colombo, Ceylon; Bakhtawar Singh Jain, Gohana, India; Francis X. H. Hayes, Dublin; John J. L. McDonald, Australia; F. L. A. Gace, South Africa; Gilbert H. Thomas, Trinidad; and Krishna Abaji Deodhar, India.

"CARDIOSPASM," CONGENITAL NARROWING OF THE ŒSOPHAGUS AND ŒSOPHAGECTASIA.*

By DAVID M. GREIG, C.M., F.R.C.S. Ed., Conservator, Royal College of Surgeons' Museum, Edinburgh.

WITHOUT the consideration as a whole of the three sections into which this communication is divided, no real understanding can be come to of the significance of each. "Cardiospasm," congenital narrowing, and œsophagectasis are inter-related but distinct. They have one occurrence in common, namely, difficulty in swallowing, and the prominence of that, and its constancy tend to obscure rather than to clarify clinical observation, and though dysphagia is often spoken of as if it were an entity, it is but a symptom, and it is always undesirable to raise a symptom to the dignity of a disease.

I. CARDIOSPASM.

Cardiospasm is a recurrent interference with deglutition by spasmodic contraction of the lower end of the œsophagus. The *recurrence* is the characteristic feature. Jordan¹ states that cardiospasm "may be constant," but this would do away with the element of spasm and the condition would then become one of permanent contraction. The anatomical "cardia" is not an area but a line of fusion between the œsophageal and gastric mucosæ, obvious on account of the difference between these two membranes. It is a gradual blend occurring at the level of the abdominal surface of the diaphragm, and it is not alleged that cardiospasm is limited to that line but that it involves the lower end of the œsophagus for some distance above it. The fact that ingested food does not regurgitate suggests some sort of trap arrangement, and such is indeed formed by the incisura cardiaca,† the impression or notch made by the diaphragm in the left wall of the cardia,

* In which is incorporated a paper communicated to the Medico-Chirurgical Society of Edinburgh, 4th May 1921.

† Professor D'Arcy W. Thompson informs me that there is in no animal a cardiac sphincter, and that the depth of the incisura cardiaca in the horse is the reason why a horse never vomits. The inability to vomit which is known to occur in some individuals is probably an inability due to an anatomical exaggeration of the normal incisura cardiaca in the human œsophago-gastric area.

“Cardiospasm,” Congenital Narrowing, etc.

but the ease with which gaseous and fluid eructations may take place indicate that the closure of the œsophagus is not a very efficient one. Indeed Jefferson² has shown that efficient control over the gastric contents is maintained by the musculature of the stomach itself, apart altogether from the muscles of deglutition.

If there existed at the cardia, a muscular arrangement differing from that in other parts of the œsophagus, there would be good *a priori* reasons to believe that cardiospasm could, and under certain conditions would, take place. But none of our text-books admit the existence of special muscle-fibres or innervation, and all agree in emphasising the difference between the cardiac and pyloric orifices.

In the normal condition of rest the upper part of the œsophagus is closed, while the lower part contains some air; and if in straining or coughing the increased intra-thoracic pressure expels this air, I fancy it is replaced by escape into the œsophagus of some of that air which is generally seen at the cardiac end of the stomach by radiography. Neither is there any physiological peculiarity which would lead us to anticipate the likelihood of cardiac spasm. In deglutition, food passed from the pharynx into the œsophagus, passes rapidly through the upper part of that tube, because of the necessity, in the lower animals at any rate, of clearing at once the respiratory passages, while the passage of food through the lower half of the œsophageal tube is carried out comparatively leisurely by œsophageal peristalsis. The pharyngeal action is entirely voluntary, the œsophageal action with the possible exception of its very commencement entirely outside the will. At the transition from voluntary to involuntary action it would not be surprising to find occasional dysphagia, and indeed such is commonly observed in the difficulty certain persons experience in swallowing drugs. This is due to an instability of nervous mechanism and is not a true spasm. It is a stammering of the muscles, which may be associated with a mental disturbance, an hysterical condition, an inherited neurasthenia or a toxic neuritis (*e.g.* alcoholism), and is without the scope of this paper further than to point out that the disturbance is limited to the commencement of the œsophagus and is not alleged to occur in its course or at its termination.

The œsophagus is not of equal calibre throughout. At its commencement the cricoidal narrowing is the most marked,

David M. Greig

but there is also a slight narrowing caused by the impingement of the aorta, the crossing of the left bronchus, and by the incisura of the cardia. At these points foreign bodies are apt to lodge, but it is not suggested that spasm is an element. The case recorded by Kelly³ seems to be unique in which a small bolus stuck in the œsophagus of an adult man *at the aortic level* during three days, and immediate relief was obtained by removal of "a foetid pultaceous mass about the size of a pea." A later report on that patient's œsophagus and nervous endowment would have been most valuable.

Stimulation of the cut vagi in the neck causes peristaltic contraction of the œsophagus with dilatation of the cardia, the essential movement of deglutition. "Vagal transmission interfered with," writes Kelly, "the œsophageal walls will relax, while the cardia will remain closed" and "obstruct the entrance to the stomach." It seems to me that this is not fairly stated, and that vagal transmission interfered with, the relaxation of the œsophageal walls banishes the *vis a tergo*, and the obstruction at the cardia is a purely physical one.

What part the sympathetic nervous system plays in the functional or sensory innervation of the œsophagus not only cannot yet be determined but cannot even be suggested, but further light may follow increased knowledge. There seems no reason to suppose that sympathetic or any other innervation provides cardio-dilator nerves, without the excitation of which the œsophageal exit is a closed door. All investigation so far seems to point to the exit never being tightly closed at all even during peristaltic action. The œsophageal muscles like other muscles, are either at rest or in activity, that is to say, either in physiological relaxation or physiological spasm, and if during the actual swallowing the fibres be unduly stretched, it is but the stimulus to increased effort.

The symptoms of cardiospasm are equivocal except only dysphagia. Jordan notes as essential features of cardiospasm: (1) A long history; (2) Difficulty in swallowing; (3) Malnutrition. His "essential features" seem ill-chosen. Surely the long history belongs to the prognosis rather than to the diagnosis, and certainly malnutrition is not always present. Jordan writes: "Typically the dilatation is very great"; but I am at one with Hill³ that cardiospasm cannot cause dilatation of the œsophagus, and Hertz and many writers emphasise the significance of the absence of sphincteric overgrowth about the cardia.

“Cardiospasm,” Congenital Narrowing, etc.

Guthrie,⁴ in his *Functional Nervous Disorders in Childhood*, writes: “Dysphagia due to inco-ordination or stammering of the muscles of deglutition has been described, but is decidedly rare. Cases of dysphagia in young infants have, however, been recorded, in which the defect seems to be a spasm or absence of relaxation of the cardiac sphincter leading to regurgitation of the food before it reaches the stomach. It must be treated by the passage of bougies and feeding by nasal tube, in hope that in time the affection may wear off. It seems to be analogous to spasm of the pylorus (John Thomson).”

Here I think the statement ascribed to Thomson errs. The analogy to spasm of the pylorus is very slight, because the anatomical structure and physiological action of the pylorus is totally different from those of the œsophagus, and because in cardiospasm no hypertrophy is ever produced, whereas hypertrophy is *the* essential feature of congenital pyloric stenosis in infants.

The nervous element is, however, important. Hertz³ mentions the case of a man of sixty who previously had perfect health in deglutition, being seized with a violent attack of “cardiospasm” at breakfast, immediately on the receipt of a violent shock from the perusal of a letter. The condition was relieved by the passage of a bougie. Parkes Weber⁵ records the case of a man of eighty who had suffered more or less from œsophageal obstruction (“cardiospasm”) during ten years. On post-mortem examination a fusiform dilatation of the lower three-quarters of the œsophagus was found; yet S. G. Shattock, who examined the parts, found that the œsophageal walls were healthy, and “as to the cardia, the muscularis is quite normal and there is no fibrosis of the mucosa.” Surely, as Hertz suggests, this was a case of want of co-ordination in the œsophago-gastric movements, in fact, a primary nervous affection, not a reflex muscular spasm. However, I refer to it here to point out the normal condition of the cardia.

The following seems a typical case of so-called cardiospasm, though I prefer to class it otherwise:—

CASE I.—The patient was of a nervous temperament, and when I first saw him was 35 years of age. From his school-days he was aware that he had to eat carefully and swallow slowly. His first experience of actual dysphagia was at the age of 18 years, when he had one day at breakfast difficulty in swallowing, because the food “stuck in the gullet.” A doctor was sent for who passed an

David M. Greig

instrument and "pressed the food down." This made him more careful in eating than ever, and he had no recurrence of the stoppage during two years. After that he had several recurrences. He found that trying to force the food down by taking drinks of water merely aggravated the discomfort, and that if he abstained from eating the bolus would generally "slip down by itself," but if not, then he had to get a bougie passed. At the age of 49, having a slight cold, he took a tabloid of ammoniated quinine. Being in a hurry, he did not dissolve it, and not having been unduly troubled with his swallowing for some years, attempted to ingest it with a draught of water. The tabloid stuck in his gullet. I saw him seven hours later, and cleared his œsophagus by passing a full-sized bougie. This gave immediate relief. In passing this instrument there appeared to be a tightness about the cardia, and on withdrawal the bougie was seen to be marked with a tiny streak of blood.

Though I give this case here as typical of "cardiospasm," the lifelong history and the clinical details point rather to one of the less degrees of congenital narrowing.

This case may be profitably compared with the following:—

CASE II.—A gentleman of middle age had long had trouble with his stomach, the symptoms pointing to pyloric obstruction with some gastric dilatation. One morning at a meal he felt some food stick in his gullet, apparently at the lower end. He immediately suffered considerable distress as the food would neither pass up nor down. He tried to wash the obstruction away by swallowing liquids, but this gave no relief (though he had no regurgitation); he failed to induce vomiting, and a doctor who was called made an ineffectual attempt to pass a rubber stomach-tube. This attempt, however, appeared to give some relief; it was not persisted in and the spasm gradually passed off. Shortly after this occurrence he was operated on for pyloric stenosis, besides which and the gastric dilatation nothing abnormal was found. During years since then he has had no return of dysphagia.

This might be cited as a typical, though single, attack of cardiospasm. It is possible, however, that the discomfort may have been primarily pyloric, and only referred to the œsophageal exit. Such an occurrence is recorded by Barton and Dent,⁶ though the dysphagia recurred and lasted longer. There was a pyloric stenosis which was relieved by gastro-jejunostomy, and nothing abnormal was to be found about the cardia.

It may be meticulous to admit "stammering of the œsophageal muscles," hysterical, or toxic or mental inability

“Cardiospasm,” Congenital Narrowing, etc.

to swallow, and refuse to recognise “cardiospasm” as a clinical entity; but it is an over-scrupulosity in the right direction. Neither anatomically nor physiologically are there arrangements of parts compatible with spasmodic closure of the cardia alone, and that only can “cardiospasm” mean. If it be used to mean anything else, then the term is wrong and ought not to be used, in that it conveys an erroneous impression of what the writer desires to describe, and accuracy of nomenclature is of the first importance to the medical practitioner as to the student. A name which conveys an erroneous suggestion of etiology ought to be discarded.

(To be continued.)

TREATMENT BY X-RAY AND RADIUM.

*With Special Reference to the Value of these Agents.**

By ROBERT KNOX, M.D.

(Continued from page 293.)

THE USE OF X-RAYS BEFORE AND AFTER OPERATION FOR MALIGNANT DISEASE.

The experience of X-ray workers goes to prove that, when used early, X-ray treatment holds out the promise of a certain degree of success. The logical outcome of such experience leads one to suggest the following definite rules for the guidance of all who wish to use X-rays as an adjunct to the routine treatment of malignant disease. 1. Preliminary treatment in cases suitable for operation. 2. Post-operative treatment of the seat of operation and areas of possible extension, *i.e.*, careful and repeated exposures of the areas drained by the lymphatics originating in the area of disease. 3. Treatment of recurrent growths. 4. Treatment of inoperable cases and recurrences of considerable size.

1. *Preliminary Treatment.*—Under heading 1 we take into consideration all cases of malignant disease, particularly when the disease originates in an accessible region. When time permits, a number of X-ray exposures should be given at regular intervals. Recognising in these cases that operation is imperative, one would not suggest any delay in operating in order that X-ray treatment should be carried out, but in the few days between diagnosis and operation a few exposures might be given. In carcinoma of the breast, to take a common example, the treatment should be commenced as soon as the disease is recognised. A full exposure should be made over the affected area and its surrounding parts; the axilla should at once get a full pastille dose. The special advantage of the latter treatment will be recognised when we state that such an exposure will result in the complete epilation of all the axillary hair in about three weeks from the date of exposure; further, a certain degree of atrophy will take place in the sweat glands of the axilla. Where time permits a second filtered dose may

* Communicated to the Medico-Chirurgical Society of Edinburgh,
2nd February 1921.

Treatment by X-Ray and Radium

be given at the end of a week. As a rule, the result of the two exposures will be a complete epilation of the axillary hair and a marked degree of atrophy in the sweat glands. Should the patient be operated upon a week after the commencement of treatment, by the time the stitches are taken out—*i.e.*, in ten to fourteen days—the condition of the axilla will be as follows: (1) hair in axilla nearly completely epilated; and (2) sweat glands undergoing atrophy. Result, diminution of the sweating in axilla, removal of hairs, and a considerable improvement in the comfort of the patient. In the majority of breast operations the discomfort of the patient from irritation of hair and accumulation of sweat in the dressings is considerable. The advantage of a clean axilla after operation should be of importance in the after-treatment. Further, the irradiation of the whole area of lymphatic drainage should help to prevent recurrence in the line of scar and stitch wounds.

2. *Post-operative X-ray Treatment of Area of Wounds and Lymphatic Drainage.*—This should be thorough and systematic, and should cover the breast, axillary, and supraclavicular regions. Treatment should be undertaken as soon as possible after the operation; it may be carried out without disturbing the dressings. An exposure once a week for the first month may be given, and thereafter once every three weeks for several months.

3 and 4. *Treatment of Recurrent Nodules and inoperable cases.*—The majority of the cases of malignant disease which come for X-ray treatment come under these classes. Many of these cases are quite hopeless from any point of view so far as cure is concerned, yet the relief of pain in many cases is marked. Early recurrence yields to repeated X-ray exposure. The routine treatment is to expose the area to X-rays at least once a week, and with filtration similar to that described under post-operative treatment. Treatment is kept up until a marked reaction is obtained over the whole area. Should the reaction be excessive the treatment may be suspended for a month and resumed at the end of that time. Under a *régime* of this kind nodules disappear gradually, pain is relieved, and the patient improves in general health. After the nodules have disappeared treatment should be continued at intervals of three weeks for at least a year, and after that should it be considered necessary.

An experience in the treatment of cancer by X-rays and

Robert Knox

radium extending over nearly twenty years has led one to the following conclusions: (1) Early recurrence in slowly growing types of carcinoma is particularly amenable to X-ray treatment (many cases show marked improvement; in others the nodules disappear and the enlarged glands slowly subside); (2) larger ulcerated areas slowly heal and leave a sound scar (several of these cases have remained healed for years); and (3) inoperable cases may by means of treatment be rendered operable. Some cases of carcinoma do not yield to X-rays or radium treatment. The explanation of the causes of failure is difficult. When the growth occurs in subjects under thirty-five years of age the prognosis is always grave; such cases recur early and do not yield to X-ray treatment; the masses slowly increase in size and the patient dies from exhaustion; other cases respond at first to treatment, then after a time the growth appears to get the upper hand and rapidly spreads. Occasionally treatment seems only to stimulate the progress of the growth; this may be due to insufficient dosage, though in several cases of this kind I have pushed the dose to the maximum degree without any apparent beneficial result.

One is frequently met with the argument that there is no conclusive proof that X-ray treatment after operation prevents the recurrence of the growth. It is no proof in any particular case which has had X-ray treatment and has not shown recurrence for years that the X-ray treatment really ensured the non-appearance of the growth. I have seen many cases of cancer years after operation with no sign of recurrence. These patients received no after-treatment. How, then, can we prove the value of post-operative X-ray treatment? It can only be done with the co-operation of the operating surgeons. Careful statistics of all the cases operated upon must be kept; two groups of such statistics must be considered. First you must ascertain the percentage of recurrence and period of recurrence in a group of cases which have not had any after-treatment. The second group should be those which have had X-ray treatment. A comparison of the two groups should enable us to ascertain definitely the value of X-ray treatment. Not only must the percentage of recurrence be taken into consideration, but any prolongation of the interval of time which elapses between the operation and the recurrence should be considered in order to aid us in our attempt to assess the value of X-rays in treatment. Should the percentage of recurrence show a

Treatment by X-Ray and Radium

marked fall, then the distinct advantage of X-ray treatment must be admitted.

When considering the value of X-ray treatment for actual recurrence we can definitely state that X-rays do cure such cases, sometimes permanently, or at all events for a period extending into years. This fact, to my mind, is a valuable one in favour of the plea for the systematic treatment of all cases of cancer after surgical operation. If by X-rays we can cure cases of actual recurrence, surely it is a logical conclusion at which we arrive to state that in all probability we can prevent the actual recurrence if treatment is pushed vigorously immediately after operation. Let us consider the method by which the cancer propagates itself in cases which have been operated upon. The commonest seat for recurrence is in (1) the scar; (2) stitch infection; (3) the outlying tissues where the growth has been left in small portions, or it may be (4) cancer cells which have been squeezed out of the mass at the time of operation; and (5) lymphatic extension. The glands may not have been completely removed. Presuming that any one of these cases is operative we commence at once to irradiate the whole area and surrounding tissue. Inflammatory action is set up all over the tissues irradiated, fibrous tissue formation results, the cancer cells are involved in the general fibrosis, and are rendered harmless. The process which we know to be effective in the treatment of actual recurrence must *a priori* be beneficial in treating cases which, in a certain percentage at least, must show recurrence.

Estimation of the value of X-rays and radium in the treatment of malignant disease, with special reference to Breast Carcinoma and Carcinoma of the Uterus.—This can only be dealt with briefly. I have already indicated the technique of the treatment in carcinoma generally. The study of carcinoma of the breast has been an extensive one, and it is evident that we owe a great deal to the pioneer worker, Sir Harold Stiles, and to Mr Sampson Handley who has demonstrated the spread of cancer by permeation. If we bear the work of these two surgeons in mind we are materially helped in our appreciation of the extent of the spread in this disease, and are clearly shown that the treatment must be very thorough if we are to hope for a successful result.

There can be no doubt of the value of the post-operative treatment by X-rays. It certainly should be a routine treatment.

Robert Knox

In breast carcinoma it is equally certain that the operative treatment should in all cases have the first choice, and no case however favourable it may be, should be submitted to radiations until the advantages of the operation have been explained.

It is equally important that the need for thorough irradiation treatment should be pointed out to the patient and the object for which it is used explained. Surgeons are adopting this method more generally, and it is especially insisted upon by Mr Sampson Handley in a recent paper published in the *Lancet*. He is also adopting the method of using radium at the operation, and claims that it has a distinct advantage in preventing recurrence.

In inoperable carcinoma radiation treatment may render the condition operable at a later day; the possibility of this should always be kept in view when treating these cases.

The position is somewhat different when dealing with uterine carcinoma, when the operative results are perhaps not so favourable as in breast carcinoma. X-rays and radium, and particularly the latter, are challenging the operative method, and in the extensive cases offer as much chance of success. Radium when properly used gives excellent local results. Carcinoma of the cervix uteri, for instance, may completely disappear after radium has been applied. The local symptoms disappear and the patient improves greatly in health. The local disappearance of the growth is, however, not a cure; the disease has infiltrated deeply into the pelvic lymphatics. Radium does not appear to check these deeper manifestations any more than the most thorough operative procedure succeeds in removing the more distant deposits of new growth cells. Radium applied internally and X-rays externally appear to offer the best chance of a cure in these desperate cases. The X-rays may in the future acquire a greater utility when more penetrating rays and much larger doses are used.

When the operative method is given the preference the patient should be advised to submit to X-ray treatment in the hope that the deeper involvements may be kept in check. I feel convinced that it is only by whole-hearted co-operation between clinicians, surgeons, and radiologists that the best results can be obtained, and that such co-operation is the best we can do for the patient.

It has been shown that the more malignant types of new growth when superficially placed are influenced by radiations

Treatment by X-Ray and Radium

when these are applied in the proper dosage. It may require a very penetrating ray even in the most superficial lesion to bring about the disappearance of the growth. When the growth is particularly resistant to treatment, I believe it is more a question of the quantity of the particular wave-length than actually the wave-length itself. Thus, if a very hard radiation is required, a relatively heavier dose of a softer radiation may bring about the same result.

Some authorities, for instance, state that radium rays are more suitable than X-rays—basing their conclusions on clinical observations. Even in deep-seated lesions X-rays, when used in the correct dosage, will induce the same changes as radium does when buried in a deep tumour. I have seen large masses of peritoneal growth disappear when very large doses of X-rays were administered through several ports of entry through the abdominal walls.* The case of Bailey is another example of the type of case in which the effect can be produced by either X-rays or radium with equal certainty. The great advantage radium possesses over X-rays is chiefly one of practical application.

As already stated, the advantages that radium possesses over X-rays are (1) the shorter wave-length of the gamma ray—and its greater penetrative power; (2) the convenience of its application in certain diseases whose site is in the interior of the body. Until very large quantities of radium are available it is more convenient to endeavour to obtain as good results with X-rays. The penetrative value must be greatly increased by increasing the power of the generating apparatus. Special tubes are required, capable of standing up to the high voltages required to produce the long spark length, and the rays must be applied in a way which makes it possible to concentrate the dose on any particular depth of tissue. All these requirements are capable of accomplishment. The apparatus has only to be specified. It is possible to make it. The tubes are already available. The actual application is not difficult. The "cross-fire" technique is well known. It consists of a number of ports of entry, the rays being centred on a particular spot from each of these ports. Mechanical contrivances are readily made which facilitate the execution of a technique of this kind.

The rotating tube is capable of administering with great

* Recent works published in Germany appear to support this view.

Robert Knox

accuracy a large dose of X-rays at a particular depth of tissue ; if X-rays are employed in this way it is possible to administer in several hours as large a dose of radiation as could be obtained from a very large quantity of radium buried in the tumour for a day or two. The advantage X-rays possess when employed in this manner is that no operative measures are required—often a point of some importance.

To take an example. Suppose that a case of epithelioma of the skin has been successfully treated by X-rays and radium, and the dose is approximately X.

The lesion being on the surface receives 100 per cent. of the beam of radiations directed upon it.

The absorption value of the particular wave-length is ascertained, and is as follows :—

1	inch of tissue	absorbs, say,	50	per cent.
2	"	"	75	"
3	"	"	85	"
4	"	"	95	"

To produce the same effect upon a tumour of similar type at say 4 inches depth from the surface will take twenty doses from as many ports of entry, as only 5 per cent. of the beam is absorbed in that depth. If the skin dose take 15 minutes then the depth dose will take $15 \times 20 = 300$ minutes or 5 hours.

When the penetrative value of the radiation is increased the absorption by the intervening tissues diminishes, and it may be possible to project 20 per cent. of the beam 4 inches into the tissues, when the 300 minutes would be diminished to 75 minutes. It is possible when using these very penetrating rays to utilise the same skin area for three or four doses ; in this way the number of ports may be diminished.

Conclusions.—It follows from what has been said that in X-rays and radium we possess most useful agents, and that extensive use should be made of these in the treatment of a large number of diseases. The value of such treatment will depend upon several factors.

- (1) The time at which it should be administered.
- (2) The nature and extent of the disease.
- (3) The response the tissues possess to stimulation. Many patients are reduced to the last point of resistance before they are treated. These cases fail to respond.

Treatment by X-Ray and Radium

(4) The dosage, which may be

- (a) Massive at one sitting or divided over several days.
- (b) Intermittent, large doses being given at intervals of from one to six weeks.

The malignant cases give the least favourable results. The earlier a case can be treated the greater is the chance of a successful result. Surgery offers in nearly all cases a better prospect than radiation treatment, so it should be given the first place, and radiation should be used after operation in the hope that recurrence may be delayed or prevented. Combined treatment should be more successful than either alone.

There are conditions of malignant disease in which surgery may not offer any better prospect than radiation, and in these it should be our aim to give the very best treatment in the hope of helping the patient. Radiations must be very thoroughly administered. In malignant disease of the thyroid, for example, it may be possible to do as much with radiation as by surgical operation. Large tumours of a low degree of malignancy may be diminished in size and their progress delayed.

In conclusion, I wish to show you slides from a case of mediastinal tumour which reflects great credit upon those who dealt with the case, and shows how advantage was taken of the therapeutic action of radium and X-rays.

The slides I show explain the nature of the tumour and its exact position in the thorax. Through the localisation of the tumour by radiograms taken in three positions, the surgeon was able to operate by opening the anterior chest wall. Excellent judgment was shown in the administration of the radium dosage, where the tubes of radium were inserted in the mass of the growth. Subsequent exposures to X-rays resulted, a year after treatment, in the production of the condition I show in the next slide. The case did remarkably well, and furnishes a most striking testimony of the great value of Rontgen's discovery of the X-rays, and the subsequent developments in the technique of diagnosis and treatment. It is a fitting illustration of the best method, *i.e.*, collaboration of the physician, the surgeon, and the radiologist.

POST-OPERATIVE MORBIDITY IN ITS RELATION TO GENERAL ANÆSTHESIA.*

By H. TORRANCE THOMSON, M.D., Anæsthetist to Leith Hospital,
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IN the first place it will be agreed that the subject of post-operative morbidity is one of great importance to the anæsthetist. I think, also, one is not wrong in suggesting that it is a subject which, as anæsthetists, we have rather tended to neglect.

There are various reasons to account for this tendency. In order adequately to study the subject, it is necessary to come in contact with the patient before and after the operation—before the operation in order that one may gain some knowledge of the patient's condition and act on that knowledge as far as possible—after the operation so that one may note the post-operative condition of the patient, and with some knowledge of the previous condition, have the opportunity of forming judgments as to the part played by the anæsthetic and as to the differing effects of the various anæsthetic agents and procedures.

Facilities for supervision of this kind are not always possible in private work. In hospital work, however, there is ample opportunity for observation, of which, I fear, we have not availed ourselves as we might have done.

A more subtle difficulty is the determination of how far the general anæsthesia is responsible for any morbid condition. There can, I think, be no question that the anæsthetist has often been used as a scapegoat, and as in earlier days there were no anæsthesia specialists, judgments of this kind were too readily accepted without due inquiry. Granted, however, that the anæsthetist or the anæsthetic was often unduly blamed, there can be no reasonable doubt that general anæsthesia has a distinct and, in certain cases, a very marked influence on the post-operative condition.

What we as anæsthetists have to do is to attempt to come to conclusions regarding the question, so that we may do our part in the way that is best in the interests of the patient.

In the following short paper I have attempted to introduce

* Communicated to the Scottish Society of Anæsthetists, 4th December 1920.

Post-Operative Morbidity

one or two aspects of this subject of Post-operative Morbidity, in the hope that they may form the basis for discussion.

Post-operative Nausea and Vomiting.—Nausea with or without vomiting constitutes the most frequent morbid state. The estimations as to its frequency vary greatly; indeed, for various reasons it is difficult to obtain accurate information in a busy hospital ward. It is important, too, to distinguish between the cases in which the patient is sick immediately on recovering consciousness, and subsequently to this has no further trouble—a condition of things one sees so frequently after chloride of ethyl anæsthesia, and cases of prolonged nausea and vomiting which may well so aggravate the state of shock as to determine an unfavourable issue.

What then is the cause of vomiting? What relation has it, if any, to the reduction of the alkali reserve, and what measures can we adopt to modify its incidence?

The question as to whether post-operative nausea and vomiting have a casual relationship with acidosis is important practically. If the reduction of the alkali reserve is the cause of the nausea and vomiting, the administration of bicarbonate of soda in sufficient quantities previous to operation should obviate the condition. The reduction in the alkali reserve is in the majority of cases a temporary one. Is it sufficiently long in operation to account for the symptoms?

Reimann,¹ in discussing this question, says: "We shall not attempt to state dogmatically in our 15 per cent. of patients who showed acidosis what symptoms were due to that condition, but we can state decisively that these patients suffered more nausea and vomiting, more headache, more gas pains, and took a longer time to recuperate than did the others who showed compensated acidosis."

Experience with cases in which bicarbonate of soda has been administered as a routine measure for forty-eight hours preceding operation points fairly strongly to the presumption that the incidence of nausea and vomiting is thereby reduced.

Opinion in the meantime seems to be divided. Caldwell and Cleveland,² for instance, state that in their series of cases, "the post-operative course as to recovery, nausea, vomiting, and headache is not appreciably affected by the treatment."

In any case it would seem to be wise to avoid anything which will reduce the alkali reserve, and in view of the fact that an excess of alkali is easily detected by an examination of

H. Torrance Thomson

the reaction of the urine, and that, moreover, it is unlikely to occur, there seems no reason why an extensive trial should not be accorded to this method of prophylactic treatment, with a view to testing the question clinically. For the rest the prophylactic treatment would be concerned with attending to the following points:—

(1) *Preliminary dietetic preparation* of the patient, with due appreciation of the fact that both fasting and purgation tend to reduce the alkali reserve.

(2) *Preliminary administration of such drugs as morphia and atropine*.—There can be little doubt that, although the cause of the vomiting, etc., is probably of central origin, an excessive secretion of mucus and saliva must at least aggravate the tendency to vomit. Adequate administration of atropine will obviate this in the great majority of cases. Morphia also will help by reducing the amount of the general anæsthetic required, and by calming the patient, will facilitate a smooth induction. It must, I think, be admitted that in a small minority of patients, morphia does, in itself, tend to the production of nausea and vomiting. The proportion of patients with such an idiosyncrasy, however, appears to be so small, that one is justified, in view of the obvious advantages in the great majority of cases, of ignoring this possibility, unless a previous experience or a definite history has revealed it to one.

(3) *Choice of anæsthetic agent*.—While this must depend on personal experience, it is generally admitted that a nitrous-oxide-oxygen-anæsthesia, with or without the judicious addition of ether, is followed by less post-operative nausea and vomiting than is the case after the use of ether or chloroform. In my own experience chloride of ethyl is followed by sickness in a considerable proportion of cases, but it is as a rule of a merely temporary character, and takes place within a few minutes of recovery of consciousness.

(4) *Smooth administration* of the smallest quantity necessary.

(5) *Gentleness* in carrying out operative manipulations, especially in abdominal operations.

(6) *Absence of unnecessary movements* in transfer of the patient from the theatre to bed.

(7) The question of *warming and moistening the anæsthetic vapour*. This question is an open one, regarding which opinions differ greatly. If it be conceded that one effect of warming the vapour is to lessen the irritation of the mucous surfaces, it may

Post-Operative Morbidity

well be, that nausea and vomiting are thereby lessened. In my own opinion, undue importance has been extended to this device.

Post-operative Chest Complications.—Here again there arises the difficulty of assigning its due place to the anæsthetic agent.

One has to remember in the first place that patients who are old or who are of a certain type, if forced to lie in bed tend to develop congestions, etc., in their lungs.

Again, one has to remember the opportunities for chilling which a patient undergoing an operation frequently encounters. There is the question of the temperature of the theatre, the exposure of the body surface of the patient, the exposure to the air of coils of intestine, the fact that perspiration is sometimes profuse, and that if adequate measures are not adopted, the body heat will be used to dry the skin of the patient, the danger of chill after operation in transit from theatre to bed.

It will be readily admitted that in the absence of a careful attention to detail the patient is liable to be subjected to distinct risks of chilling and depression of vitality, and that one of the effects of this, especially in a person predisposed to chest trouble, may be the development of a patch of pneumonia, or congestion, or a bronchitis. Having granted this, there can, I think, be little doubt that the anæsthetic does play a part in post-operative chest conditions, and that in this connection ether is the agent most to be feared.

It is doubtful whether the administration of ether would, in skilled hands, at all frequently be followed by trouble if the careful attention to detail referred to above were regularly carried out.

Be that as it may, it would seem to be important:—1. To hesitate before giving ether for any time to a patient suffering from or who has recently suffered from such lung trouble as bronchitis. 2. To be sure that the ether is pure and prepared for purposes of anæsthesia. 3. To guard against the possibility of chill. 4. Question of warming and moistening vapour. It is doubtful if warming the vapour acts by preventing the lowering of the blood temperature to any appreciable extent. It would seem to be much more important to attend to the general warmth of the patient. It may well be, however, that warming and moistening the vapour may lessen irritation. It may perhaps be said that the clinical evidence appears to be in

H. Torrance Thomson

favour of the beneficial effects while the contention can hardly be supported on purely scientific grounds. 5. Preliminary administration of atropine. This is especially important where ether is the agent used.

General Anæsthesia and Shock.—The most important aspect of the question of post-operative morbidity in its relation to general anæsthesia concerns itself with the part played by the general anæsthetic in those cases in which there is a greater or less degree of shock at the time of the commencement of the operation, or in which, through the severity of the operation or a complication such as hæmorrhage, shock becomes established.

It is not possible to introduce an account of the Clinical Pathology of Surgical Shock. Mr John Fraser has recently contributed to the *Edinburgh Medical Journal*³ an excellent critical review of the subject, and I content myself by suggesting that a careful perusal of this paper which gives an account of the most recent conclusions reached, will well repay anyone who undertakes it. I wish, however, to quote the general conclusions reached, and also some arrived at regarding the question of acidosis. Many of the findings herein referred to are the outcome of work carried out during the war by the Medical Research Committee, and are embodied in the report⁴ which I also commend strongly to your notice.

Firstly, then, it should be noted that a mere reduction of the alkali reserve does not in itself constitute an acidosis. Such a reduction as is seen in operations in normal persons is not accompanied by any appreciable fall in blood pressure, and is soon compensated by the protective mechanisms of the body. Cannon states⁴ that acidosis is present when the plasma holds less than 50 per cent. CO_2 after being exposed to an atmosphere such as is present in the alveoli and in the final air of an extreme expiration. There is then said to be an increased hydrogen ion concentration.

As regards the question of the significance of acidosis, Fraser³ sums up the conclusions reached as follows:—

1. Acidosis in the sense of a simple reduction of the bicarbonate of the blood plasma is not the cause of shock or an important factor in its production.

2. Experimentally in dogs it has been found that the pressure could be kept at 80 m.m. for an hour without a reduction of the alkali reserve. Below 60 m.m., however, a reduction always

Post-Operative Morbidity

occurred. After a 20 per cent. hæmorrhage a pressure of 80 m.m. for an hour reduced the alkali reserve, *i.e.*, produced an acidosis.

3. A progressive uncomplicated fall in the alkali reserve is the result of the inadequate oxygen supply to the tissues.

4. Oxidation of the tissues is more easily rendered inadequate by defective circulation through the capillaries than by a reduction of the oxygen-carrying power of the blood or of oxygen tension in the inspired air when the circulation is kept at an efficient level.

5. The progressive uncompensated fall in the alkali reserve is a symptom of a deficient capillary circulation and not a cause of such.

The general conclusions as to the nature of Surgical Shock are thus stated :—

“The essential underlying factor in the pathology of Surgical Shock is a prolonged and progressive fall in blood pressure.”

“The causes which may inaugurate the fall of blood pressure are various; some are nervous, some clinical. Hæmorrhage and the absorption of toxic products from injured tissues are powerful collateral and sustaining factors in the production of shock.

“Cold is probably an important factor in effecting a delay in the capillary situation, and when long continued it depresses all the body functions.

“With the establishment of a low blood pressure, something of the nature of a vicious circle comes into play. The prolonged hypotension leads to suboxygenation of the body tissues, and a capillary stasis. The capillary stasis reduces the amount of circulating fluid, and the suboxygenation of the tissues results in the appearance of various toxic products from imperfect tissue metabolism. All of these collectively further reduce the blood pressure, and so the vicious circle goes on. It will continue to a fatal issue unless some link in the chain is broken and the error of the blood pressure overcome.”

It has been established by many observers that operations under general anæsthesia are accompanied by a reduction in the alkali reserve of the blood plasma.

Crill found that both ether and nitrous oxide produce immediate increase in the H-ion concentration of the blood. Caldwell and Cleveland² made observations in 123 cases and noted :—

H. Torrance Thomson

1. Average normal reading is between 58 to 60 per cent. CO_2 in blood plasma.

2. A diminution in alkalinity in twenty-four hours prior to operation, probably due to fasting and purging.

3. A further diminution during anæsthesias of 44 to 58 m.

4. Diminished alkali reserve compensated for largely in first twenty-four hours after operation.

5. Operations under local as well as general anæsthesia show diminution.

6. Negligible difference between the various types of anæsthesia as to degree of diminution. After CHCl_3 some delay in return to normal.

7. That a larger percentage of nitrous-oxid-oxygen cases have no nausea and vomiting than follows other anæsthetics, although the series shows a rate of diminution equal to that of the gas and ether series.

Morris⁵ reports observations which agree substantially with the above. While, however, he expresses the opinion that the administration of sodium bicarbonate before operation is a rational precautionary measure against post-operative vomiting, Caldwell and Cleveland conclude that the "post-operative course as to the recovery, nausea, vomiting, and headache is not appreciably affected by treatment with alkali."

Reimann¹ states that in his opinion in 80 to 85 per cent. of the run of operated cases a compensated acidosis results from anæsthesia, an uncompensated is from 15 to 20 per cent.

In a series of cases reported by Cannon,⁴ of men operated upon whose CO_2 capacity was below 50 per cent. at the time of operation, or below it at the end of anæsthesia, "the average drop in CO_2 capacity at the end of operation was twice as great as that reported by Caldwell and Cleveland in ordinary civil cases. The fall was greater, too, the lower the original capacity. In other words the more marked the acidosis, the more sensitive is the patient to operative procedures, and the more likely is he to be let down by them into a region of danger. Also there was a striking fall of blood pressure as the result of operation in these cases."

"In experience with patients in whom the decrease of CO_2 capacity as the result of operation did not extend below 50 per cent. (*i.e.*, where there was no true uncompensated acidosis), no noteworthy alteration in the blood pressure occurred."

Post-Operative Morbidity

"This ominous sinking of the blood pressure has been repeatedly seen during operation on shock cases in which the alkali reserve was not determined."

Briefly summarised :—

1. Operation under anæsthesia is accompanied by a reduction in the alkali reserve of the plasma. This does not necessarily constitute an acidosis, and in the ordinary course of events is not accompanied by any noteworthy or continued fall in blood pressure.

2. In cases of genuine acidosis, operation under anæsthesia is accompanied by a big drop in the CO_2 capacity; the lower the original capacity the bigger the drop, the more rapid the fall, the more serious the condition. There is also as the result of the operation a striking fall in the blood pressure which is the fundamental factor in shock.

The important questions which we, as anæsthetists, have to consider are :—

- (1) Does the anæsthetic contribute to this result?
- (2) Does one anæsthetic agent contribute to it more than another?
- (3) What steps can the anæsthetist take to minimise any deleterious effect which the anæsthetic produces in these cases?

The answer to the question as to whether the anæsthetic is responsible for, at any rate, some of the ill effects following operation in shocked cases, will be based partly on experimental evidence with anæsthetics, in the absence of operation, and partly on the observation of results following the administration of different anæsthetic agents in operation on shocked patients.

If uniformly better results are obtained in shocked cases after the use of one agent than after the use of another, then it is obvious that the anæsthetic does contribute in some way to the ill effects prone to be experienced after operation in such cases.

Moreover the study of a sufficient number of cases ought to give us an approximate idea as to how much of the evil effect following operation in shocked cases is due to the operation and how much to the anæsthetic.

Cattell ⁶ summarised as follows the main points of a research carried out by him first in France during the war, and later at the Harvard Physiological Laboratory.

H. Torrance Thomson

(1) Ether given to the normal animal caused merely a temporary and brief fall in blood pressure followed by a return to normal. In shocked animals, however, there is a marked sensitiveness to ether, a marked and continuous drop in blood pressure being produced by the same degree of anæsthesia which in the normal animal does not interfere with the blood pressure.

(2) Increased sensitiveness to ether is brought about by any circumstances which tend to depress the general condition of the animal, *e.g.*, low blood pressure, hæmorrhage, severe operation, or the injection of acid into the circulation.

(3) In the shocked animal, sensitive to ether, N_2O and oxygen may be given so as to produce the same degree of anæsthesia produced by ether without causing a fall in the blood pressure.

Crile,⁷ testing the point experimentally, found that under approximately equal trauma the changes in the brain cells were approximately three times as great under ether as under N_2O -O anæsthesia. Whatever view one takes of the brain cell changes referred to, it is justifiable to take them as an index of the blood pressure in the brain. Crile also found that the fall in blood pressure was on the average two and a half greater under ether than under N_2O -O, and finally that the condition of the animal was worse after trauma under ether than after equal trauma under N_2O -O anæsthesia.

He concluded, therefore, that while the brain-cell changes resulting from a surgical operation are not due to the inhalation anæsthetic *per se*, yet their extent is to a considerable degree determined by the anæsthetic which is used. As these changes are less marked under N_2O -O than under ether, the former should be the inhalation of choice.

Cannon,⁴ in the summary of his paper on acidosis in cases of shock, etc., states that "operation on men suffering from shock and acidosis results in serious and rapid sinking of arterial pressure when it is already low, and a marked and sudden decrease in the alkali reserve of the blood when that reserve is likewise already low. This change may not occur if N_2O -O anæsthesia instead of ether is employed, but that anæsthetic affords no guarantee against the ominous decline."

If one accepts these findings one is justified in concluding:—

(1) That the anæsthetic *per se* is capable of adversely

Post-Operative Morbidity

affecting the condition of the patient in operative procedures on shocked patients.

(2) That the choice of the anæsthetic agent used may be a matter of importance. The latter conclusion involves the question of the superiority of N_2O-O anæsthesia in such cases, at any rate over such general anæsthetics as ether and chloroform. Moreover, as in any given case of operation under general anæsthesia, we cannot be sure that such factors as hæmorrhage, prolonged operation, or abnormal chilling may not convert a so-called normal case into a more or less shocked one, the further question arises whether in routine operative work N_2O-O should not be the anæsthetic of choice.

Experimental work, and the experience of those who have given the method of N_2O-O anæsthesia an extensive trial suggest at least a strong probability that this question must be answered in the affirmative.

In considering a question of this sort, it is the part of wisdom to be on one's guard against prejudices which are likely to be operative. Amongst these may be mentioned the regrettable fact that in this part of the world, at any rate, the facilities vouchsafed to one for any extensive trial of N_2O-O in hospital practice are at present conspicuous by their absence. Again in private work the apparatus which has to be transported from one Home to another is somewhat cumbersome, the gas is expensive, and the method is not as a general rule sufficiently appreciated by surgeons to make adequate remuneration an easy matter. These points are noted not as arguments against the use of the method, but as prejudices to be guarded against in coming to a decision.

As a result of the consideration of the points deduced in this short paper, and of my own personal experience, I cannot help believing that any one who learns to use N_2O-O efficiently will become more and more convinced of its advantages over such anæsthetics as ether and chloroform, and will desire to use it not merely in specially selected cases, but in all cases in which there is no special contra-indication.

It is well, too, to bear in mind the increased post-operative comfort and freedom from post-operative vomiting and malaise which undoubtedly follow the administration of N_2O-O as compared with ether or $CHCl_3$ in the majority of cases.

It may not be out of place at this stage to call attention to a point which is perhaps not sufficiently appreciated, namely,

H. Torrance Thomson

that whatever anæsthetic be used, the depths at which the anæsthesia is maintained should never be greater than that consistent with the requirements of the surgeon and the safety of the patient. This is one of those points in which the co-operation of the surgeon and the anæsthetist is so essential. Surgeons vary greatly in their demands upon the anæsthetist in such a question as the amount of relaxation necessary in abdominal operations, and it is desirable that they should not be too exacting in this respect.

In conclusion we must consider various prophylactic measures which aim at reducing post-operative morbidity, in the cases under consideration.

Firstly, we must remember the importance of the emotional factor in producing shock.

Anyone who has read Cannon's work on *The Bodily Changes in Fear, Hunger, Pain, and Rage*, will realise what a profound effect such emotions as fear and pain may have on the secretions of the body. Biologically considered such effects are protective, but in the abnormal conditions of a patient about to be operated on, this result on the patient may be very harmful. Crile⁷ was among the first to emphasise the importance of the emotional factor, and to insist on the necessity of avoiding its operation as far as possible.

The treatment aimed at accomplishing this is simple enough, and consists in a general way of reassuring the patient, treating him with gentleness and consideration, and in dulling his sensibility by such drugs as morphia and scopolamine. As Crile puts it, "No detail is too petty."

To minimise post-operative discomfort especially in abdominal operations, Crile injects hypodermically at some distance from the wound quinine and urea hydrochloride $\frac{1}{6}$ to $\frac{1}{2}$ per cent. solution. The effects of this local anæsthetic last for several days, so that by its use the patient is protected from nociceptive impulses from the operative field until the healing process has well begun.

Fasting and purgation are to be avoided.

Caldwell and Cleveland² found that "with rare exceptions cases receiving no sodium bicarbonate before operation showed a lower carbon dioxide tension in the specimen taken immediately before the anæsthesia as compared with the specimen taken the day before. This undoubtedly is due in part to their fasting state, dinner the evening before and breakfast on

Post-Operative Morbidity

the morning of the operation having been omitted, and in part possibly to the preliminary catharsis."

As fasting and purgation are, within limits, desirable, a compromise will be effected by the preliminary exhibition of alkali.

Pre-operative administration of bicarbonate of soda. Apart from the above reason, and also for the possible influence on the tendency to post-operative nausea and vomiting, there is ample evidence that the administration of sodium bicarbonate previous to operation reduces the danger of operation in shocked patients, and, moreover, may act as a preventive to the development of shock. In a paper contributed to the Medical Research Committee's report on "The Preventive Treatment of Wound Shock"⁴ by Cannon, Fraser, and Lowell, this question is fully dealt with. They conclude that (1) "The acidosis which prevails in cases of low blood pressure is associated with such sensitisation of the body that surgical operation may result in a serious increase of the acidosis and a perilous sinking of the blood pressure. The question as to the causal relation between low blood pressure and acidosis has been discussed, and it appears that the two conditions may interact, each contributing to the development of the other. Under these circumstances, advantage would be gained by protection against each of the conditions, first against the development of the sensitising acidosis, and secondly against the increase of acidosis and the further fall of blood pressure which occur at operation."

(2) By the pre-operative administration of sodium bicarbonate the alkaline reserves of the body can be greatly increased even in unfavourable circumstances. Since acidosis develops in shock and involves a definite risk when operation is undertaken, its avoidance should be sought. The recommendation is offered that wounded men be provided with a warm drink containing a drachm or 4 grams of sodium bicarbonate at suitable relay posts on their way from the front to casualty clearing stations.

Further, when an alkaline injection is given at the start of an operation "it prevents the dangerous depressive effects which the anæsthetic and operative procedures have on cases of shock with acidosis. The operation ends not with an increase of the existent acidosis, but with the acidosis overcome and a normal alkaline reserve provided, and the blood pressure instead of being lowered is actually raised during the critical period.

H. Torrance Thomson

The blood pressure may fall to some extent later, but the improved state of the patient during operation is unmistakable, and the subsequent course of shock cases operated on with the precautions described above have been highly gratifying."

In a later paper in this series on acidosis and shock, the writers say that, "With regard to the measures for restoring an efficient circulation, certain points may be noted: Transfusion of whole blood is probably the measure likely to have a successful result in the largest proportion of cases, provided its application is not unduly delayed. . . . In a large proportion of cases, infusion of gum saline solution will be almost as effective."

A full discussion of these questions will be found in the report of the Medical Research Committee.

Reference has already been made to the deleterious effects of chilling, and to the necessity of gentleness in manipulative operative procedures. The former is only to a limited extent within, the latter entirely, beyond the sphere of influence of the anæsthetist, but the importance of attending to both points cannot be exaggerated.

In concluding this somewhat concentrated survey of a large subject, I would like to stress the paramount importance of a close co-operation between the surgeon and the anæsthetist.

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CLINICAL RECORD

A CASE OF DOUBLE CONGENITAL HYDRONEPHROSIS.*

By R. W. JOHNSTONE, M.D., F.R.C.S.E., and FRANCIS
J. BROWNE, M.D., F.R.C.S.E.

IN view of the comparative rarity of this condition as a cause of death in the new-born infant, and of the interest in the subject of neonatal pathology which is now becoming manifest amongst obstetricians in general, we have thought the following case worthy of being brought before the notice of the Society.

The infant in question was born ten days before the expected date, but showed no evidence of prematurity except some rather unusual softness of the cranial bones. The parents were cousins, the mother a particularly strong, healthy woman, the father also very healthy except for a spastic condition dating from his birth. The labour was not complicated except in that low forceps were used owing to some rigidity of the perineum.

Immediately on its birth the child, a female weighing six and a half pounds, cried lustily, and as it appeared normal no special attention was paid to it. On my returning to visit the mother some four hours later the nurse remarked that the child seemed cold and its extremities were bluish. Instructions for the maintenance of the body heat were given, but as the child seemed quite well no anxiety was felt.

Two hours later the child suddenly became white, and although immediate efforts were made to stimulate and revive it, it died within a few minutes. I saw the body some ten minutes later and noticed that the abdomen was a little larger than usual.

I shall leave it to Dr Browne to record the findings at the post-mortem examination made next day. I would here draw attention to two points only.

The first is that the literature of the subject shows that, although a rare condition, congenital hydronephrosis is quite recognised as a cause of death at or immediately after birth, but more commonly in later life. Double cases are naturally the soonest fatal. Different causes have been found to account for the kidney condition, and where no cause has been found

* Communicated to the Edinburgh Obstetrical Society, 12th January 1921.

R. W. Johnstone and Francis J. Browne

various imaginary causes have been invoked as explanation. Thus valves in the ureter or at the origin of the ureter from the renal pelvis have been blamed. In other cases the ureters have joined the kidney pelvis at an angle which has obstructed the outflow of urine. In some bands or adhesions have been present kinking the ureter; while in others the ureters have been more or less stenosed or actually imperforate. In connection with the question of stenosis, it may be recalled that the larger the dilatation of the renal pelvis the more gradual has the obstruction probably been. Sudden or complete obstruction arrests the functions of the kidney on the affected side. Gradual or partial stenosis or obstruction allows the secretion of urine to proceed, and the dammed up urine distends the renal pelvis. Casper states that partial stenosis of the ureters is the commonest cause of the condition in the congenital variety, and adds that the sites of predilection appear to be the outlet of the ureter from the renal pelvis, and the part of the ureter that passes through the bladder wall.

The second point to which I wish to direct attention is that in our case there was a small associated defect of the skin on both hands. This consisted in a small patch, about a quarter of an inch square, on the back of each hand, over which the epithelium was removed as if by the action of a blister or by scratching. The dried epithelium was attached at the side of the area as a flap, leaving the true skin of the denuded area dull red or purple in colour. It suggested to the eye that the child had scratched itself *in utero*, for the lesions were quite obviously not recent. But the exactly symmetrical arrangement of the two patches made that explanation an unlikely one. Dr John Thomson has kindly drawn our attention to an article by Abt of Chicago who has collected a number of cases of similar congenital skin defects. Apparently they are commonest on the scalp, but are also found on the limbs and trunk. Many authors have attributed them to the results of amniotic adhesions, or to degenerative changes. But the absence of any sign of inflammation or of any degenerative changes on histological examination indicates that these views are untenable, and we are driven to take refuge in the explanation of them as "errors of development." They are frequently found associated with other developmental defects as in this case, but are also found without any such association, and even in otherwise perfectly normal children who survive.

Double Congenital Hydronephrosis

Pathological Findings.—The body was that of a full-time female infant of average size. The abdomen was somewhat distended. The cord was still fresh, and presented a peculiar appearance, in that immediately under the surface and somewhat projecting, there were five or six small hæmorrhages, each rounded and circumscribed, and about the size of a grain of No. 3 shot. On cutting into them dark fluid blood escaped. These were not present at birth, and had not been noticed before death.

On the back of the left hand was an abrasion of the skin, long oval in shape, situated over the interspace between, and parallel to the first and second metacarpals, and measuring $\frac{1}{2}$ inch by $\frac{1}{4}$ inch. On the right hand there was a similar abrasion, but situated a little more towards the ulnar border of the hand on the dorsal surface of the second metacarpal. These were removed and examined microscopically.

Brain.—Showed nothing abnormal.

Thymus, Thyroid, and Heart.—Were normal.

Lungs.—Showed terminal œdema and congestion of the lower lobes.

Abdomen.—On opening the abdomen its right side was found to be occupied by a cystic swelling the size of a cricket ball. This was found to be connected with the right kidney. The left kidney, before removal from the abdomen, seemed small but otherwise normal. The bladder was empty and contracted. It was removed, together with the ureters and kidneys, and the fluid in the cystic right kidney was drawn off for analysis. It was a watery, slightly blood-stained fluid, sp. gr. 1011, reaction acid, and contained a fair amount of albumen, but no urea. The organs were then hardened in formalin. The large cyst was afterwards laid open, and its wall was found to be formed of the kidney capsule with a peritoneal covering. Its lining was smooth, and to the upper surface of the kidney a little fresh blood-clot was attached. The kidney itself, minus its capsule, formed the posterior wall of the cyst, the large collection of fluid being thus contained between the kidney and its capsule. The kidney was elongated and flattened by the pressure of the fluid. Projecting on its surface were four small cysts, varying in size from a hazel-nut to a small horse chestnut. A few other small cysts lay deep in the kidney substance, and these seemed to have no communication with the pelvis. (Fig. 1.)

On laying open the left kidney the pelvis and calyces were found to be dilated and filled with watery fluid. There was, however, still a considerable amount of kidney tissue left.

Ureters.—The upper half of each ureter was contracted so that a stilet passed from the bladder end could not get farther than about midway, and on attempting to pass a stilet from the pelvis of the

R. W. Johnstone and Francis J. Browne

kidney it was found to be impossible to pass it farther than about 2 mm. into the ureter. On laying open the pelvic end of either ureter no lumen could be seen. A small part of each ureter, about 1 inch below the pelvis of each kidney, was taken and examined microscopically.

All the other organs, including the liver and spleen, appeared to be normal. There was no evidence of chondro-epiphysitis.

Microscopic Findings.—*Brain, thymus, and thyroid* were normal.

Lungs.—Showed marked congestion and œdema and areas of hæmorrhage into the alveoli and bronchi. There was no thickening of the alveolar walls, but there was definite thickening of the walls of the vessels and bronchioles.

Liver.—Showed a notable increase of hæmopoietic cells in the sinusoids, indicating a continuance of the blood-forming function of the liver into post-natal life. There was no cirrhosis.

Kidney.—A section taken through the wall of one of the dilated calyces of the left kidney shows the following appearances: There is a marked increase of interstitial tissue, the newly formed fibrous tissue compressing and destroying the tubules so that these are very few in number, and those that are left have their lumen considerably dilated. This applies to both the collecting and convoluted tubules, and is in itself, on embryological grounds, sufficient to exclude congenital cystic kidney. One or two tubules are markedly dilated so as to form small cysts. In one of these the epithelium is still present though flattened, in another it has completely disappeared. The interstitial fibrosis is most marked in the region close to the dilated calyces and pelvis and gradually becomes less marked towards the cortex. (Fig. 2.)

Ureters.—A section of right ureter shows that there is a lumen though much smaller than normal. It is lined by normal transitional epithelium, but the crenated appearance of the normal mucous membrane is entirely lost. The muscular coat is almost entirely replaced by fine fibrous tissue, which lies between the muscle fibres, separating them widely and causing pressure atrophy. There are also present large numbers of cells mostly mononuclears, and fibro-blasts, possibly forerunners of the new connective tissue. It is also noteworthy that the new connective tissue formation is most marked in the part of the muscular coat farthest from the lumen, and seems, therefore, to have commenced at the outside and to be extending, inwards. (Fig. 3.)

In the left ureter the condition is much more advanced and the lumen is entirely obliterated by a fibrous tissue proliferation, and muscular tissue in the wall of this ureter has entirely disappeared. The blood-vessels supplying this ureter appear to be normal. (Fig. 4.)

The *skin* sections showed that the whole epidermis, including the

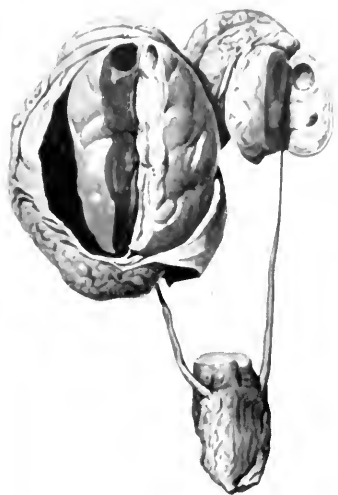


FIG. 1.

Right Kidney.

Left Kidney.

Bladder.



FIG. 2.—LEFT KIDNEY.

Increase of interstitial tissue with atrophy of tubules, those that remain being dilated. At lower part of picture is the wall of one of the dilated calyces.



FIG. 3.—RIGHT URETER.

Proliferation of fibrous tissue. Muscle fibres much separated and atrophied. Lumen narrowed.

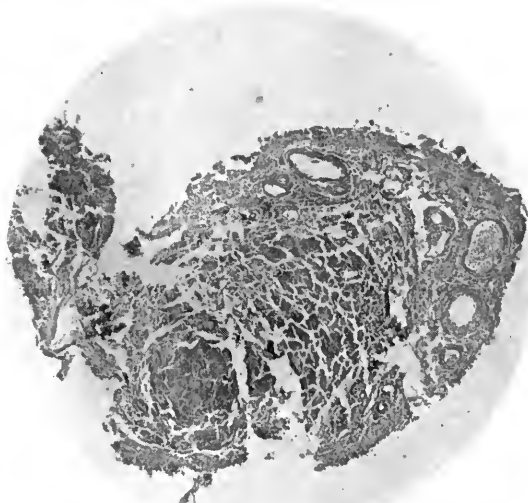


FIG. 4.—LEFT URETER.

Complete obliteration of lumen by fibrous tissue proliferation. The blood-vessels in the wall do not seem to be thickened.



Double Congenital Hydronephrosis

rete mucosum, had been removed and the cutis vera exposed. There was no inflammatory reaction and no apparent attempt at healing. The skin, excluding the epidermis on either side of the abraded area appeared to be normal.

The Wassermann reaction on the father was negative, and *Levaditi* stained sections of the fetal organs failed to show *spirochaetes*.

CONCLUSIONS:—1. There is therefore present in the ureter a chronic inflammatory change involving chiefly the muscular coat, and giving rise to a new connective tissue formation which causes thickening of the wall, atrophy of the muscle, and stenosis of the lumen of the ureter on the right side, and on the left complete obliteration.

2. The stenosis of the right ureter interferes with the free exit of fluid secreted by the kidney, with secondary dilatation of the kidney tubules into cysts. On the left side the complete obliteration of the ureter has resulted in cessation of secretion and partial atrophy and sclerosis of the kidney tissue.

3. The primary condition is not developmental, but probably a chronic inflammatory ureteritis occurring during foetal life.

CRITICAL REVIEW

A STATISTICAL SURVEY OF TUBERCULOSIS OF THE SKIN.

By F. GARDINER, M.D., F.R.C.S.E.

THE question of tuberculosis of the skin is to a great extent that of tuberculosis generally. The worst cases are found in debilitated persons, but there are many points of origin and spread which are passed lightly over by most writers and are far from clear. The case of a surface lesion becoming infected with tubercle bacilli is simple, as in the post-mortem wart, but even in the case of local injury it is quite possible that the lowering of the vitality of the part by the injury will produce a suitable nidus for the growth of the tubercle bacillus which is in the circulation or the lymphatics.

From the observation of many cases during past years the impression is left that there are only two methods of infection, either (1) direct infection locally, or (2) through the lymphatic system, and the writer has analysed the statistics drawn from 146 male and 209 female cases coming under his observation at the Royal Infirmary, Edinburgh.

Age at Onset.—Up to twenty years, roughly 90 per cent. of all the cases occur in the male, and 80 per cent. in the female—more minutely between the ages of one and ten 68 per cent. in the male and 44 per cent. in the female; while at ages above twenty there is only 10 per cent. in the male and 20 per cent. in the female.

Leloir¹ finds 70 per cent. of the cases under twenty and 55 per cent. up to eleven and a half years.

Hamlyn and Jones,² quoting from Sequeira's cases, only give details of the age of commencement of 92 cases, and 90 of these commenced before twenty, and 63 before ten years of age.

These figures all agree in pointing out that the infection is rare after twenty, and that most cases commenced before ten years of age with the probability of later development in the female cases.

Leloir mentions certain periods of life which are the most frequent times of onset. These are three years, six years, ten years, fourteen years, and twenty years. He offers as explanation the lymphatic disturbances occurring at these times.

Sites affected at Onset.—In the personal cases, 102 males and 149 females—roughly 71 per cent. of both—were affected primarily on the face. The nose was affected in 15 per cent. of males and 30 per cent. of females.

Statistical Survey of Tuberculosis of the Skin

The total statistics of the sites affected at age of onset are :—

	Males.	Females.	
Face and nose	102	149	= 71 per cent.
Nose alone	22	63	= 23 „
Scalp	0	2	= .05 „
Hands and arms	47	40	= 24 „
Legs	35	23	= 16 „
Body	10	4	= 4 „

It is to be noticed that some of these cases had lesions on several areas.

When comparing other statistics it is found that, especially on the Continent, what the writer regards as an almost impossible distinction is attempted to be drawn between lupus vulgaris and tuberculosis of the skin generally, so that some cases are excluded, but that need not affect the percentages.

In a recent article by Carl With³ the figures deduced from the Finsen Institute are given. He states he is dealing only with lupus vulgaris, and so far as can be made out from his figures, which in fairness it may be said are not expressly given for this purpose, less than 55 per cent. originated on the face in adults over sixteen, and 32 per cent. on the nose, probably becoming less in younger years. Max Bender⁴ reports 76 per cent. on the face and 25 per cent. on the nose. Leloir's figures appear to show 68 per cent. originating on the face region while the nose was affected in 34 per cent. Méneau and Frèche⁵ give a percentage of 78.5 affecting the face. Forschammer finds 81 per cent. affecting the face.

The next most frequent sites are the arms and hands affecting about 30 per cent. of males and 19 per cent. females. Carl With lays stress on the extremities being more frequently attacked in younger children. Leloir's figures show about 15 per cent. affecting the limbs.

Many explanations have been given for the frequency of attacks on the face. Carl With, while admitting its relation to the mucous membrane of the nose, suggests such factors as make the skin of the face the place of predilection of many skin diseases, these being changes in the weather affecting the finer structure of the skin, and light having a particularly injurious effect, which is worse in early spring.

Mucous Membrane.—The importance of the affection of the mucous membrane has long been emphasised.

Bender, for instance, out of 380 cases found that 31 per cent. had *commenced* in the mucous membrane while 45.5 per cent. *involved* the mucous membrane. Finsen reports 70 to 80 per cent. of lupus shows tuberculosis of the mucous membrane of the nose and mouth.

Leloir found out of 312 cases 109 affected, but in only 21 of these

F. Gardiner

did it arise originally from mucous membrane. He confesses, however, that he did not always make a rhinoscopic examination, and suggests the possibility of many cases being overlooked and being treated as coryza or eczema.

In 1897 Méneau and Frèche discussed the nasal origin of lupus of the face. As lupus of the face is much commoner its importance is very evident. Their conclusions are that this arises, in the majority of cases, in the mucous membrane, whether it be the nose or the lachrymal sac. Their statistics are based on 121 cases, of which 95 involved the face, giving a percentage of 78.5.

Hamlyn and Jones, in a paper which deals with cases arising secondarily to tuberculosis of the skin, purposely exclude those in which tuberculous glands are an accompaniment only. Like Carl With they lay great stress on the area in the middle of the cheek. Of their 923 cases 47.3 per cent. arose on the face and 28.9 per cent. on the nose or the nostril and 1.8 per cent. from mucous membrane other than the nose, generally the margin of the lips.

In the personal cases very few were found showing a definite tuberculosis of the naso-pharynx. The writer can only say in reference to this that, if it is not in agreement with other statistics, the cases were examined by experts of the Ear and Throat Department of the Royal Infirmary. The last 54 cases were taken very particularly, and of these 41 affected the face, including 16 affecting the nose, and only 9 ($16\frac{1}{2}$ per cent.) were reported to have definite tuberculosis of the naso-pharynx. Of great significance, however, was the number of cases which came back with a report of slight pharyngitis and often complaining of nasal catarrh. Probably the diminished vitality of the mucous membrane leads to ready permeation by the tubercle bacilli into the adjoining glands of the neck or cheek.

Strausse is quoted by Méneau and Frèche as stating that "the tubercle bacillus may occur upon a healthy mucous membrane, and otherwise it is often very difficult to affirm the existence of lupus when there is only irregularity of the mucous lining." The discharge is often ignored by the patient for many years.

Carl With finds that lupus of the mucous membrane is comparatively rare in children. He asserts that probably about the age of puberty the nose becomes more susceptible. He gives 149 cases in which lupus occurred first on the mucous membrane of the nose, compared with 55 in which it started on the surface of the nose. Thirty-one per cent. of all the cases affected the nose, and in women it is much more frequent, but under the age of eleven the percentage is only 15.

Glandular Affection.—The next point to be considered is the question of origin in the glands. Hartzell⁶ quotes from Fox that

Statistical Survey of Tuberculosis of the Skin

30 per cent. of 96 cases suffered from glandular disease. Hamlyn and Jones' 923 cases—which again, it is to be remarked, exclude those in which tuberculosis of the glands is an accompaniment only—find 11.4 per cent. secondary to tuberculosis of the glands. They lay stress on the buccinator gland of the cheek. Fox finds 30 per cent. of his cases suffered from glandular disease. Carl With finds 258 cases affecting the neck, and 151 of these were due to spread from deeper lymphatic glands. 212 cases involved the masseter region and 49 from glandular suppuration. The pre-auricular region was affected in 159 cases and 49 originated from glands. He also emphasises the importance of the area in the centre of the cheek, and while quoting Lewandowski as maintaining that this arises from an underlying lymphatic gland in the middle of the cheek, he personally believes that the focus here has a hæmatogenous origin.

Leloir in one table reports 32 out of 312 cases, and elsewhere 41 as originating from the deeper glands, and he gives a list of the glands most commonly affected in the order of precedence. These are the sub-maxillary, parotid, pre-auricular, retro-auricular, and sub-auricular, the chain of the sterno-mastoid, epitrochlear, and axillary.

In the writer's own cases a record of the commencement of 200 has been obtained, and of these 35 males and 59 females—total 94—gave histories of origin in the glands, generally about the neck.

To continue to follow up the writer's statistics on these lines it is important to go to the 9 males and 23 females who give histories of a nasal mucous membrane being the original site. These, with 2 starting in the conjunctiva and lachrymal sac, form a total of 128 out of 201 where infection has come through the mucous membrane of the nasopharynx as we may well presume that glands in the neck mostly originate from this.

Another interesting group is that of 12 males and 17 females, in which the disease followed one of the eruptive fevers. The explanation generally given, and probably correct, is that the fever breaks down some old central focus and allows the passage of the tubercle bacilli into the lymphatics and blood supply. This last type is very characteristic in the simultaneous appearance of nodules on various parts of the body.

Ten male and 7 female cases give a previous history of bone infection, the discharge from which, like that from the glands, readily infects the skin.

With regard to cases of direct external infection, 18 males and 5 females give a history of previous injury. With these we may well associate the 4 cases in males where the disease is reported to have followed vaccination. Apart from the vaccination these male cases occur up to thirty years of age, and we may explain the greater

F. Gardiner

frequency in males by the greater activity and liability to injury of the sex.

To summarise we might say that with the exception of this last group all the other cases originate from the infection of the glands or bones, and secondary infection of the skin. The characteristic spread of tuberculosis on the face is strongly suggestive of its lymphatic origin. Recently, the writer saw a case in which the naso-pharynx had been scraped with evident imperfect occlusion of the lymphatics, and numerous lesions appeared on the face, and another in which a perfect scar on the neck with removal of underlying enlarged glands was noted in a boy with multiple lesions over the body appearing a few weeks after the operation.

The following statistics are instructive—injury and, curiously enough, vaccination infection are more common causes in the male. Fevers, except during the ages from one to five, more commonly affect the female, and the nasal affection is not only more common in the female but also appears later in life. Bone disease is apparently more common in the male.

SOURCE OF INFECTION.

Taken from Age at Onset.

Age.	Glands.		Injury.		Vaccination.		Fever.		Nasal.		Bone.		Eye.	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Under 1	2	3	0	0	4	0	0	2	0	0	0	0	0	0
1 to 5	8	9	4	3	0	0	10	6	0	0	5	3	0	0
5 " 10	11	24	5	0	0	0	2	3	2	5	3	0	0	1
10 " 15	8	5	3	1	0	0	0	4	2	5	2	3	0	0
15 " 20	3	7	0	0	0	0	0	0	4	6	0	1	0	0
20 " 25	1	3	4	0	0	0	0	1	0	2	0	0	0	0
25 " 30	1	2	1	1	0	0	0	1	0	2	0	0	1	0
30 " 35	0	3	0	0	0	0	0	0	1	1	0	0	0	0
35 " 40	0	0	0	0	0	0	0	0	0	2	0	0	0	0
40 " 45	0	2	0	0	0	0	0	0	0	0	0	0	0	0
45 " 50	1	1	0	0	0	0	0	0	0	0	0	0	0	0
50 " 55	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55 " 60	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60 " 65	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Total	35	59	18	5	4	0	12	17	9	23	10	7	1	1

The conclusions to be drawn from these statistics are, first, that if the system can be kept free up to twenty years the liability of development is very slight. The risk of continuance, however, is greater in the female than the male.

As regards the sites affected the percentage of cases involving the face is about the same in these as it is in other statistics. When the

Statistical Survey of Tuberculosis of the Skin

site of origin is considered the high proportion of glandular disease is very marked, and also equally remarkable is the number of cases in which there was no definite tuberculosis of the naso-pharynx.

It follows then that apart from the prevention of infection through a local wound, the main point is the provision of healthy mucous membrane, and one of the products of civilisation is undoubtedly the unhealthy mucous membrane—generally perhaps the naso-pharynx, but also the gastro-intestinal. At this stage one need scarcely mention the greater liability to air-borne infection through the naso-pharynx, and to milk-borne infection of the gastro-intestinal mucous membrane.

REFERENCES.—¹ Leloir, *La Scrofulo-tuberculose*, 1892. ² Hamlyn and Jones, *British Journal of Dermatology*, September 1907. ³ Carl With, *British Journal of Dermatology*, October 1920. ⁴ Max Bender, see Crocker's *Diseases of the Skin*. ⁵ Méneau and Frèche, *Annales de Dermatologie*, 1897. ⁶ Hartzell, *Diseases of the Skin*.

NEW BOOKS

The Diagnosis and Treatment of Peripheral Nerve Injuries. MEDICAL RESEARCH COUNCIL. Pp. 59, with 18 illustrations. London: His Majesty's Stationery Office. 1920.

This is the first report of the Committee upon Injuries of the Nervous System. It begins by outlining the general principles governing the examination and treatment of "Nerve Injuries in General," and passes on to the application of these principles to lesions of "Special Nerves." Then follows the "Histological Examination of Injured Peripheral Nerves," and lastly, a consideration of "Pain with Injuries of Peripheral Nerves," including "Causalgia" and the "Nervous Sequelæ of Amputations."

The opening words of the Introduction give a hopeful summing-up of the results obtained by modern methods of treatment:—"Most cases of injury to the peripheral nervous system make a good recovery, provided that treatment is carried out systematically and over a long period of time." It is interesting to know that "the prognosis of nerve suture is as good when two or more years have elapsed since the date of the injury as when an early operation has been performed." The text is eminently practical, avoids all academic discussion, and excels in brevity, lucidity, and interest; the illustrations are well chosen and instructive.

On Bone Formation—Its Relation to Tension and Pressure. By DR MURK JANSEN, O.B.E. Pp. 114, with 54 illustrations. London: Longmans, Green & Co. 1920. Price 20s. net.

Jansen investigates the grounds on which the opinion is based—that tension as well as pressure forms a stimulus to bone formation. His findings are that tension leads to a thinning-out of bone elements and a lengthening of this thinned-out bone; that certain pressure stresses stimulate bone formation, but that tension never does. He finds further that only the pressure of function—functional pressure—has power of bone formation, and that intermittence and remittance of the pressure have little or no influence. There are set limits to the power of functional pressure on bone formation, and over and above these mechanical stresses, purposive factors must be recognised whereby "the bone cells seem to strive with means and in ways which show similarity with the means and ways which our judgment would adopt."

The text is well illustrated with excellent full-page photographs, which worthily complete this notable addition to our knowledge of the laws of bone formation.

New Books

Basal Metabolic Rate Determinations. By W. M. BOOTHBY, A.M., M.D., and I. SANDIFORD, Ph.D. Pp. 111, illustrated. Philadelphia and London: W. B. Saunders Company. 1920. Price 24s. net.

As the authors state in their preface "New methods of precision for the study of disease are continuously passing from the purely scientific to the more practical clinical application. The most recent of these methods of precision and probably the most difficult technically is indirect calorimetry." It is with this difficult subject that the authors have dealt in this admirable monograph. The general discussion of basal metabolism is clear, and outlines the principles upon which indirect calorimetry is employed to determine this important physiological factor. In section two, the details of technique are gone into thoroughly. The importance of preparing the patient in order that the basal metabolism may be correctly obtained is justly emphasised, and the errors, which may be consequent upon the non-observance of a strict routine, are pointed out. The various types of apparatus which are described are well illustrated both by photographs and by diagrams. The authors describe in detail the use of all the instruments required to carry out the determinations, while many useful hints are given for keeping the various pieces of apparatus in working order. The third section deals with the calculation of the basal metabolic rate, and gives in detail the determination of the various corrective factors which are necessary. In the appendix a complete set of useful tables are given which renders many of the calculations simple and are of great aid.

The importance of basal metabolism as a clinical procedure has not received the attention which it deserves, but this small monograph will undoubtedly be of great aid for those interested in this important method of precision.

Investigation of the Central Nervous System. By R. H. CLARKE, M.A., M.B., and E. E. HENDERSON, B.A., M.B., F.R.C.S. (Baltimore: The Johns Hopkins Press.)

The first part of this monograph describes and illustrates a new stereotaxic instrument, with explanations and directions for its use. The purpose of the method and instrument is to give such practical effect as may be possible to the principle of substituting mechanical for visual direction of needles and similar fine instruments for intracranial operations, whether they are required for anatomy, physiology, or surgery, in the hope of ultimately reducing to small proportions the mutilation which exposure of the structures of the brain entails. *The inter-aural line*, i.e., a line from the centre of one meatus to

New Books

the other, is the focus and central zero of measurement, and from repeated experiment it has been established that the structures through which such a line passes are remarkably constant, and, as other structures may all be related to such a line, it at once becomes possible to direct a needle so that a definite lesion may be produced with trifling injuries to other parts. Stimulation of deeper structures may also be carried out with accurate localisation, and, if hollow needles are used, drugs may be introduced into definite areas of the brain. The instrument is described at length. Great care has been taken so that the variation in the different size of heads may be compensated for, and much ingenuity has been expended in perfecting the instrument. Special reference may be made to the plates which are very clear.

The second part consists of photographs of frontal sections of the cranium and brain of the rhesus monkey. These form the third part of an atlas of which the first two numbers, representing sagittal and frontal sections of the cat, were published before the war as supplements of the *Journal für Psychologie und Neurologie*.

Diseases of the Throat, Nose, and Ear. By DAN M'KENZIE, M.D., F.R.C.S.E. Pp. xv + 646, with 201 illustrations. London: William Heinemann (Medical Books), Ltd. 1920. Price 42s.

In his preface the author states that his book has been written from the practical point of view, and for that reason many interesting and scientific problems have necessarily been omitted. It is therefore the book of Dr Dan M'Kenzie's practice in Oto-Laryngology. Naturally he is inclined to be dogmatic, but this is useful, more especially as the book is eminently suitable to the general practitioner with leanings towards this specialty. The book is very readable and there is a welcome absence of what may be called "padding." The major operations in the specialty are well described, and we observe that the thyroid gland is included as evidently within the scope of the Ear and Throat Specialist.

One is not informed that the old Kiesselbach area has now become Little's area. As Dr M'Kenzie was the first to point out Little's prior claim, a fuller explanation would not have been out of place. He gives a valuable word of caution regarding the exhibition of salvarsan in cases of syphilitic deafness, and definitely lays it down that deafness and vertigo contra-indicate the exhibition of the salvarsan group. This volume may be confidently recommended to the practitioner, and is also of interest to the specialist.

NOTES ON BOOKS

Its graphic style and practical character placed Dr Robert Hutchison's *Lectures on Diseases of Children* (Edward Arnold) in the forefront of works of its class when it first appeared. The characteristics which secured the success of the earlier editions are equally apparent in this, the fourth. The text has been carefully revised, and a useful chapter on fevers of obscure origin has been added. It is certainly one of the most useful text-books that a student or practitioner can possess. The illustrations are excellent, and well bring out the clinical features of the diseases portrayed.

Much that was originally written by Sir James F. Goodhart thirty-five years ago remains true to-day, but this eleventh edition of his work, *The Diseases of Children* (J. & A. Churchill), edited by Dr Still, includes the many fresh advances which have been made in the science of Pediatrics. Thus all the latest theories in regard to the chemical pathology of the nutritional disorders of infancy are fully discussed, and many illustrations have been added.

Under the rather misleading title *Infant Education* (London: Henry Kimpton, 1920, 6s. net), Dr Eric Pritchard has published a series of lectures to mothers on the care of infants. The Child Welfare movement has produced a considerable number of books of this type; they are quite harmless, inasmuch as they say nothing valuable that every sensible mother does not know, and we suppose they must be useful to the ignorant and foolish. But one wonders, sometimes, if they are really worth while.

The seventh edition of *Surgical Pathology and Morbid Anatomy*, by Sir Anthony A. Bowlby and Sir Frederick W. Andrewes (J. & A. Churchill, price 30s. net), contains new chapters on Gas Gangrene, Shock, and Tetanus. In addition the whole text has been brought thoroughly up to date. Many new illustrations have been added and the old ones have been redrawn and are reproduced on a larger scale than formerly. The scope of the text-book is such as to make it useful for students rather than for graduates.

Dr Marsh Pitzman has endeavoured in *The Fundamentals of Human Anatomy* (Henry Kimpton, price 24s. net) to give the student an understandable account of human anatomy, without burdening his memory with an excess of detail. He tries also to indicate the practical bearing of anatomical facts as well as to take note of sidelights from physiology, embryology, histology, and other borderland subjects. The book is arranged also so that it may be used as a

Notes on Books

dissecting manual. To attempt to accomplish so much in the compass of some 350 pages is certainly ambitious.

The intentions of the author are to be commended, but it is to be feared he has attempted too much in so small a space. Descriptions as a rule are too brief to be of any use to the student. A structure like the ulnar nerve is disposed of in half a dozen lines, and with the remark that "in general it tends to supply the medial half of the hand and fingers," individual muscles in the hand being ignored. It is difficult to see how the book can hold a useful place in the teaching of students.

The Synopsis of Surgery by Ivor Back and A. Tudor Edwards (J. & A. Churchill, price 15s. net) takes its place in that already long list of books which have been written to enable the "less industrious majority" of students to revise their work for the final examination. The synopsis covers the whole of General and Regional Surgery, with specially contributed sections on Venereal Diseases and Diseases of Ear, Nose, and Throat. Very short descriptions of the standard amputations are also included. If the student will realise that this volume is not intended to replace the larger text-books, no doubt it will have a sphere of usefulness.

A Guide to Anatomy for Students of Medical Gymnastics—Massage and Medical Electricity, by E. D. Ewart (H. K. Lewis & Co., 16s. net), is written by one who has knowledge both as a teacher and an examiner of the requirements of Students of Medical Gymnastics. The text is concise and the diagrams are extremely clear and well charted.

Dr Rixon and Dr Matthew's little brochure on *Anxiety Hysteria* (Lewis, London, 1920) will be found very useful by those who have to deal with this troublesome class of case. It is simple, sane, and sensible, and can be recommended.

Dr Arthur Hurst has republished in book form the Cromian Lectures delivered in 1920, under the title of *The Psychology of the Special Senses* (Hodder & Stoughton, London, 12s. 6d. net). Dr Hurst's work at Seale Hayne is well known to all interested in psychology, and many will be glad to have the lectures in this compact form.

A sixth edition of diseases of the *Lungs and Pleuræ* by Sir R. Douglas Powell and P. Horton Smith Hartley (H. K. Lewis & Co., Ltd., price 42s.) has appeared. New chapters have been added on gunshot wounds of the chest, chylothorax, massive collapse of the lung, sporotrichosis and artificial pneumothorax, and the newer work on the bacteriology of pneumonia is included. Irritant gas-poisoning is briefly mentioned, but no reference is made to ultimate results.

Notes on Books

In the section on pulmonary tuberculosis a timely warning is given about the emigration laws in relation to this disease. Hilum tuberculosis is considered briefly, and the authors think it is "an unnecessary addition to the nomenclature." The diagnostic value of X-rays in pulmonary tuberculosis is considered by the authors to be very limited.

Physical Signs in the Chest and Abdomen, by A. J. Jex-Blake (J. & A. Churchill, price 9s. 6d.) is primarily of value to students, and offers a good general introduction to the clinical methods commonly employed in the examination of the chest and abdomen. The larger part of the work is devoted to the chest, and only the commoner diseases are considered. There are some good diagrams illustrating the graphic representation of physical signs.

Dr Einhorn in *The Duodenal Tube* (W. B. Saunders Company, price 13s. net) has given a concise yet complete account of the duodenal tube and its possibilities. He reviews the history of the development of this method of diagnosis and treatment, compares the various instruments, and outlines their advantages and disadvantages. In the chapter on the examination and diagnostic importance of the duodenal contents many points of practical importance are dealt with, and the use of this instrument as a therapeutic agent is briefly reviewed. It is a valuable monograph for all who are interested in the diagnosis and treatment of duodenal conditions.

Text-Book of Tracheo-Bronchoscopy, by Sanitätstrat Dr M. Mann, Dresden-Friedrichstadt (John Bale, Sons, & Danielsson, Ltd., price 31s. 6d.) is the translation by Mr A. R. Moodie of a book which appeared in 1914. According to the translator, no advances of importance have been made either as regards the method itself or in its application. The anatomy of the parts gets scanty consideration, but a considerable portion is devoted to the history of the specialty and armamentarium. Cases are quoted describing practically every variety of foreign body that has been encountered. The book contains practically all the cases published up to 1914. Chapters on the diseases of the Tracheo-Bronchial tree, with notes as to their treatment by the direct method, are of considerable interest.

Surgical Aspects of Dysentery, by Zackary Cope, F.R.C.S. (Henry Frowde and Hodder & Stoughton, price 12s. 6d. net). The large number of men who served in tropical climates during the war, and who with few exceptions suffered from dysentery, has made an acquaintance with the late manifestations of this disease a necessity to all medical men in this country. The author from a wide experience gained in Mesopotamia has produced a monograph which, while dealing with the surgical aspects of the disease, includes an excellent

Notes on Books

account of the pathology of the condition in its various stages. The benefits to be derived from appendicostomy and cæcostomy in the chronic ulcerative types of dysentery are very clearly demonstrated, and the indications for one or other of these operations well defined. Contrary to usual belief strictures of the colon and rectum following dysentery are shown to be very rare indeed. The chapter dealing with amœbic hepatitis and liver abscess are tersely written and beautifully illustrated, and form the feature of an admirable book which can be confidently recommended to all interested in the subject, and particularly to those who are to practise in tropical countries.

The Medical Examination of Airmen, by Drs Maublanc and Ratié, of the Châtres School of Flying (John Bale, Sons, & Danielsson, Ltd.), confirms the opinion that we have held for some time that in no small proportion of the crashes said to be due to "engine trouble" it is the human engine which has "missed." By carefully carrying out the routine detailed in the above work, and especially in regard to fatigued or even apparently healthy pilots, the human element contributing to these often preventable disasters can be reduced to a minimum. The translation from the French is by Norman Bale.

Within four years another, a seventh, edition of Dr Robert Jardine's *Practical Text-book of Midwifery for Nurses* (Henry Kimpton, 1920, price 7s. 6d. net) has been called for. The text has been brought up to date, and one or two illustrations have been added. This book deservedly continues to be in great demand by nurses training for the Central Midwives Board Examination, and no more useful guide could be found for them. It also proves a most reliable help to junior students commencing the subject of Obstetrics.

Nitrous Oxide Oxygen Analgesia and Anæsthesia in Normal Labour and Operative Obstetrics is the title of a monograph published by the National Anæsthesia Research Society. A great many testimonies have been gathered together here in favour of nitrous oxide oxygen anæsthesia; but one quotes, with a little satisfaction, the sentence "Nitrous oxide is no panacea for poor obstetrics," as a word or two of permanent value.

A Consulting Surgeon in the Near East (Christophers) is a record of Colonel A. H. Tubby's experiences as a consulting surgeon with the Armies of the Middle East from July 1915 until after the Armistice. He deals with those anxious days for the medical service when they had to evacuate their wounded from the shell-swept beaches at Helles, Anzac, and Suvla, direct to the hospital ships, and he has good words to say for the part played by the "Black Ships," transports and liners commandeered as hospital transports. The book also contains

Notes on Books

particulars of Colonel Tubby's service at Alexandria with the Egyptian Expeditionary Force. It is brimful of interest, and will prove a valuable addition to the medical history of the war from a personal standpoint.

The best part of Dr Crow's *Pyorrhœa Alveolaris in its Clinical Aspect* (Baillière, Tindall, & Cox, price 6s. net) is the foreword by Sir Frank Colyer. The book itself contains some false statements and many unjustifiable conclusions, but the object of the author is a good one, viz., "to emphasise once again the overwhelming importance of pyorrhœa alveolaris in the causation of many of the diseases and minor complaints met with in medical practice."

In *The Auld Doctor* (Constable & Co., price 3s. 6d.) Dr David Rorie has put within reach of the general reader a selection of the poems and songs in Scots with which he has so often amused and delighted his medical friends at social gatherings. They will appeal most strongly to men of the North, who can dispense with the glossary provided for their less favoured brethren.

Six Papers by Lord Lister is the first instalment of the new Medical Classics Series to be issued by Messrs John Bale, Sons, & Danielsson, Ltd., under the general editorship of Dr Charles Singer. Sir Rickman J. Godlee contributes an admirable short biography of Lister, and explanatory notes to the six papers selected for reproduction. These include the historical papers on Inflammation, Anæsthetics, the treatment of Compound Fractures, Antiseptic Surgery, and Fermentation. Those who have not ready access to the Collected Papers will welcome this judicious selection of Lister's writings. The price is 10s.

A fifth edition of Mr Hey Groves' *Synopsis of Surgery* (John Wright & Sons, Ltd., price 17s. 6d.) has appeared, which shows that this class of work is still in demand.

Medical Notes by Sir Thomas Horder (Henry Frowde and Hodder & Stoughton, price 6s.) is a series of somewhat obvious aphorisms.

Dr Wm. Sharp has detailed his extensive experience of head injuries in a large volume entitled *Diagnosis and Treatment of Brain Injuries* (J. B. Lippincott Company, price 35s.). Considerable space is devoted to injuries of the brain in new-born babies, which is perhaps the most interesting section of the work.

The handsome Centenary volume of Charles Griffin & Co., Ltd. (1820-1920), constitutes a record of which this famous publishing house may well be proud. The contributors include such well-known names as those of Sir W. S. Abell, Professor Hudson Beare, and Professor W. Gowland, and there is a preface by Lord Moulton. The place which

Notes on Books

Messrs Charles Griffin hold as publishers of scientific and technical work is very high, and English science and technology are greatly in their debt. We venture cordially to congratulate the firm on having been able to produce such a striking tale of its activities for its centenary volume.

Women as Army Surgeons by Flora Murray (Hodder & Stoughton), gives a most interesting description of the doings of this band of women who so successfully organised and ran a large military hospital for over four years.

The Principles and Practice of Medicine, by Sir William Osler and Thomas M'Crae (D. Appleton & Co., price 30s. net), now appears in its ninth edition, which has been thoroughly revised and brought up-to-date. There is a great deal of new material, as shown by the sections on Paratyphoid Fever, Focal Infection, Trench Fever, Acidosis, Diverticulitis, Infectious Jaundice, Hæmothorax, Mediastinitis, Epidemic Encephalitis, etc. Many of the other parts have been rewritten and recent work added. The book is designed for the use of the practitioner and the student. The former will find it a help in his practice, the latter that it is easily read, and the arrangement of the sections helpful to him.

Essentials of Medicine, by C. P. Emerson, M.D. (Lippincott, price 12s. 6d. net), is a manual of medicine intended for nurses, which might also with advantage be read by medical students before beginning the study of clinical medicine. The various systems and their diseases are considered in order, as in a more elaborate text-book, and the descriptions are throughout expressed in clear, non-technical language. The diagrams are very helpful in the explanation of pathological conditions in the organs concerned. The principles of treatment in each disease are indicated, but not given in detail. The book is well planned and written for the object in view.

Drs Sillar and Lambie have reduced the essentials of *materia medica* to pamphlet form. For *Selected Materia Medica* (James Thin Edinburgh, 2s. 6d. net) generations of students will rise and call the authors blessed, and unless we are much mistaken the little book will have a large and steady sale.

It is unnecessary to do more than note the appearance in book form of Rows and Orr's *Functional Mental Illnesses* (Oliver and Boyd 1920, 3s. 6d. net) which has already appeared *in extenso* in the pages of this journal.

The rat, according to Prof. Shipley, shares with certain species of insects the distinction of being man's greatest enemy on this earth. Whether this be so or not, rats are disagreeable vermin, and better away, wherefore Mr Dewberry's monograph on *The Destruction and*

Notes on Books

Prevention of Rats (John Bale, Sons & Danielsson, Ltd., 1920) deserves circulation among farmers and property owners generally. It may be described as a Rat-catcher's Gospel, and costs a modest florin.

The third edition of Col. Blackman's *Military Sanitation* (John Bale, Sons and Danielsson, Ltd., price 10s. 6d. net) has been largely rewritten to incorporate the numerous lessons which have been learnt as a result of war experience. All aspects of this important subject are fully discussed and an appendix is added giving in tabulated form the Communicable Diseases of Soldiers, their chief characteristics, and preventive treatment.

Lectures on Surgery for Nurses, by Alan H. Todd (Edward Arnold, price 7s. 6d.), is based on a course of lectures delivered to probationers at Guy's Hospital, and gives concisely and simply the essential facts of Pathology and Surgery. The illustrations are excellent. Nurses commencing their training should find this book of considerable value.

A Text-book of Pharmacology and Medical Treatment for Nurses, by Dr Fortescue Brickdale (Henry Frowde and Hodder & Stoughton, price 28s.), is a well-prepared handsome volume whose production is creditable to the publishers. The author has assumed a difficult task, as he has had to present a highly technical subject to an almost lay clientele. He has, therefore, had to adopt his terminology and descriptions accordingly, and to limit the amount and range of information imported. He has succeeded in presenting his subject clearly, and appears to have produced a work which ought to be of use to nurses as a book of reference. It will appeal more to senior nurses than to beginners, and its price will probably tend to limit its circulation. The illustrations add greatly to its value and are well chosen. The author has very wisely devoted most space to the therapeutic part of his subject, and has useful chapters on Organotherapy and Serum therapy. His explanations of the rationale of treatment will enable nurses to carry out their work with a better knowledge of what they are doing.

Obstetrics, Normal and Operative, by George Peaslee Shears, B.S., M.D. (third edition, revised by Philip F. Williams, J. B. Lippincott Company, price 35s. net), can be confidently recommended as giving a clear account of the present-day teaching of obstetrics. Throughout it bears the impress of the writer's individual experience. The main outlines of the literature are given, and in matters still under discussion a fair balance between opposing views is maintained. The illustrations are good. A very large number are borrowed from well-known continental and other text-books. The book is one which is suitable both for students and practitioners.

Notes on Books

That a second edition of the *Elements of Hygiene and Public Health*, by J. P. Medi (Butterworth & Co., price 12s. net), should have been found necessary, proves that his book has supplied a want among Indian medical students. The teaching is sound and simple. The section dealing with Village Sanitation is well done, and a like compliment can be paid to the chapter dealing with Tropical Diseases. There is no fear of Preventive Medicine in India if this handy volume is carefully studied by the students and medical practitioners, for whom it is intended.

The call for a sixth edition of Professor M'Murich's *Development of the Human Body* (Henry Kimpton, price 18s. net) is eloquent testimony to its popularity and success. In the present volume several chapters have been recast so as to enable the author to include references to important recent work without overloading the book and making it too large. This is still the most satisfactory small book on a difficult subject with which we are familiar.

Notes on Midwifery, by J. M. Munro Kerr, M.D., and Jas. Hendry, M.A., B.Sc., M.B. (second edition, Maclehorse, Jackson & Co., price 10s. 6d. net), is a synopsis in note form of Professor Munro Kerr's lectures to his students in Glasgow. It is, therefore, superfluous to say that the subject-matter is beyond criticism. It is printed on one side of the page only, so that the student can fill out the print from the lecture as delivered. It will be useful to students preparing for examinations, and to teachers who wish to revise a subject rapidly. There are numerous textual errors of an obvious nature.

In the volume of the "Students' Synopsis Series" devoted to *Physiology*, Dr Ffrancon Roberts (J. & A. Churchill) has most successfully condensed the essentials of the subject within a compass suitable for the student. We specially commend the work to the final year student who desires to revise his physiology as an aid to his study of medicine and surgery.

Dr Ibbotson's *Atlas of the Sensory Cutaneous Nerves* (Scientific Press) is a handy means of refreshing the memory on points which can neither be carried continuously nor entirely forgotten.

Sir Charles A. Ballance has reprinted his Bradshaw Lecture on the *Surgery of the Heart* (Macmillan & Co., Ltd.). It contains a record of the subject from the earliest times to the present and is abundantly documented.

The life-story of *Elsie Inglis* has been retold by Lady Frances Balfour in the "Young Citizen Series" (British Periodicals, Ltd.), and by her sister, Eva Shaw M'Laren, in the "Pioneers of Progress Series" (S.P.C.K.). It is a story that cannot be too widely diffused as an example and an inspiration to the young.

Notes on Books

When Professor Schmeiden's *Course of Operative Surgery* (Baillière, Tindall & Cox) first appeared ten years ago, we formed a high opinion of it, and we find no reason to modify our opinion after a study of the second edition, which is now before us. It has been prepared in collaboration with Mr Arthur Turnbull, and has a foreword by Professor August Bier. The illustrations are admirable.

The *Transactions of the American Surgical Association*, vol. xxxvii., 1919 (Philadelphia, W. J. Doran), is largely taken up with surgical problems connected with military surgery, but following the lead given by Dr Pilcher in his presidential address, an attempt is made by some of the writers to apply the lessons learned in warfare to the needs of civilian practice. With the lapse of time this is the aspect of military surgery that has most interest for the civil surgeon, and from this point of view we can commend this collection of essays.

George Miller Sternberg: A Biography, by his wife, Martha L. Sternberg (American Medical Association), is of general interest as dealing with the career of a man who was intimately concerned in some of the most important phases of American history, the Civil War, the Indian Wars, and the Spanish-American War. Apart from this, it has a great professional interest in that General Sternberg was Surgeon-General of the U.S. Army Medical Department when the Yellow Fever Commission was appointed in 1900. The important work of that Commission in elucidating the transmission of the disease, from which arose the far-reaching means for its eradication, is described in correspondence published in this volume. It forms a very readable record of an assiduous worker and attractive personality.

American Medical Biographies, by H. A. Kelly, M.D., and W. L. Burrage, M.D. (Norman, Remington Company), includes over 1900 biographies of medical men who have attained a measure of distinction in the United States and Canada during the past three hundred years. It does not include names of those still living in 1918. The work appears to have been carried out with great care and success by a large staff of contributors. Naturally its general interest is greater on the western side of the Atlantic, but for everyone concerned with the development of medical science, practice and teaching, it forms an invaluable work of reference.

BOOKS RECEIVED

A MIDLAND DOCTOR. Letters to a Nurse (<i>John Bale, Sons and Danielsson, Ltd.</i>)	5s.
ARTHUS, MAURICE. De l'Anaphylaxie à l'Immunité . (<i>Masson et Cie.</i>)	FRS. 20
BARR, M. W., and E. F. MALONEY. Types of Mental Defectives (<i>H. K. Lewis & Co., Ltd.</i>)	16s.
BURR, CHARLES W. The S. Weir Mitchell Oration (<i>College of Physicians, Philadelphia</i>)	—
CALOT, F. Translated by A. H. ROBINSON. Indispensable Orthopædics. Second English Edition (<i>Baillière, Tindall & Cox</i>)	42s.
CATHCART, E. P. Physiology of Protein Metabolism (<i>Longmans, Green & Co.</i>)	12s. 6d.
COLES, A. C. Critical Microscopy (<i>J. & A. Churchill</i>)	7s. 6d.
DAUKES, S. H. Barrier Charts for Health Officers (<i>Baillière, Tindall & Cox</i>)	3s. 6d.
DURET, H. Traumatismes Cranio-Cérébraux. Tome II. (<i>Librairie Félix Alcan</i>)	—
ELLIOT, R. H. Tropical Ophthalmology (<i>Henry Frowde and Hodder & Stoughton</i>)	3s. 6d.
FLINT, H. L. The Heart—Old and New Views (<i>H. K. Lewis & Co., Ltd.</i>)	15s.
GLAISTER, JOHN. A Text-Book of Medical Jurisprudence and Toxicology. Fourth Edition (<i>E. & S. Livingstone</i>)	30s.
GORDON, ALFRED. French-English Medical Dictionary (<i>H. K. Lewis & Co., Ltd.</i>)	16s.
INTERNATIONAL CLINICS. Vol. IV. Thirtieth Series (<i>J. B. Lippincott Company</i>)	—
JOHNS HOPKINS HOSPITAL REPORTS. Vol. XX., Fasc. III. Vol. XXI., Fasc. I. (<i>Johns Hopkins Press</i>)	—
JOHNSTON, T. B. Regional Anatomy (<i>J. & A. Churchill</i>)	12s. 6d.
LUCIANA, LUIGI. Human Physiology. Vol. V. (<i>Macmillan & Co., Ltd.</i>)	30s.
MARTINDALE, W. H., and W. W. WESTCOTT. The Extra Pharmacopœia. Vol. II. Seventeenth Edition (<i>H. K. Lewis & Co., Ltd.</i>)	17s. 6d.
MEDICAL ANNUAL, 1921 (<i>John Wright & Sons, Ltd.</i>)	20s.
MOORE, ALFRED E. The Rat and How to Kill Him (<i>John Bale, Sons & Danielsson, Ltd.</i>)	9d.
PARKER, C. A., and LIONEL COLLEDGE. The Nose and Throat and their Treatment. Second Edition (<i>Edward Arnold</i>)	25s.
SVEDBERG, THE. The Formation of Colloids (<i>J. & A. Churchill</i>)	7s. 6d.
VERNES, ARTHUR. Atlas de Syphilimétrie (<i>A. Pradier, P. Boll, Paris</i>)	FRS. 35
WHITTAKER, C. R. A Manual of Surgical Anatomy. Third Edition (<i>E. & S. Livingstone</i>)	15s.

I N D E X

(*Crit. Rev.*)=Critical Review. (*Cl. Rec.*)=Clinical Record.

(*Ed.*)=Editorial Note

- ANÆSTHESIA, General, Post-operative Morbidity in its Relation to (H. T. Thomson), 356
- Analytical Notes, 133
- Anaphylaxis in Man: Its Bearing upon Hay-Fever, Animal and Food Idiosyncrasy, and Asthma (Charles M'Neil) (*Crit. Rev.*), 188
- Appointments, 134, 135
- Asthma, Hay-Fever and Animal and Food Idiosyncrasy, Anaphylaxis in Man: Its Bearing upon (Charles M'Neil) (*Crit. Rev.*), 188
- Ballantyne, J. W.*, Problems of Population and Parenthood (*Crit. Rev.*), 55
- Barnes, Henry*, see Obituaries
- Biliary Ducts, Surgery of the Gall-bladder and (James M. Graham) (*Crit. Rev.*), 254
- Boyd, Francis D.*, Two Cases of Renal Decapsulation in Subacute Diffused Nephritis, 104
- Brachial Neuritis treated by Stretching of Brachial Plexus (D. M. Greig) (*Cl. Rec.*), 247, 336
- Plexus, Stretching of, for Brachial Neuritis (D. M. Greig) (*Cl. Rec.*), 247, 336
- Browne, Francis J., and Johnstone, R. W.*, A Case of Double Congenital Hydronephrosis (*Cl. Rec.*), 369
- Caird, F. M.*, Intestinal Tuberculosis, 73
- Calmette's Protective Vaccination of Cattle against Tuberculosis, and its Possible Application in Man (Th. Shennan) (*Crit. Rev.*), 318
- Capsule-Stripping Operation for Subacute Nephritis (John Fraser) (*Cl. Rec.*), 117
- Carcinoma of the Stomach in a Boy aged Fifteen (D. A. Laird), 98
- "Cardiospasm," Congenital Narrowing of the Œsophagus and Œsophagectasia (D. M. Greig), 342
- Cathcart, Charles W.*, Epididymitis and Orchitis from Muscular Strain, followed by Tuberculosis of the Epididymis, 152
- Cattle, Calmette's Protective Vaccination of, against Tuberculosis, and its Possible Application in Man (Th. Shennan) (*Crit. Rev.*), 318
- Children, Chronic Nephritis in, Four Cases of, treated by Decapsulation (J. W. Simpson) (*Cl. Rec.*), 115
- Clinical Records, 51, 53, 111, 115, 117, 186, 247, 250, 369
- Congenital Hypertrophy on the Pylorus (John Thomson), 1
- Narrowing of the Œsophagus, "Cardiospasm," Œsophagectasia and (D. M. Greig), 342
- Critical Reviews, 55, 121, 188, 254, 318, 374
- DEATH, Prenatal (Arthur Robinson), 137, 209
- Decapsulation, Four Cases of Chronic Nephritis in Children treated by (J. W. Simpson) (*Cl. Rec.*), 115
- of the Kidney for Chronic Nephritis, Three Cases of (J. S. Fowler) (*Cl. Rec.*), 111

Index

- Decapsulation, Renal, in Subacute Diffused Nephritis, Two Cases of (Francis D. Boyd), 104
- Double Congenital Hydronephrosis, a Case of (Johnstone and Browne) (*Cl. Rec.*), 369
- Dunlop, J. Crawford*, see Appointments
- EDITORIAL Notes, 337
- Embryological and Morphological Data, Human Gestation and Our (James Oliver), 245
- Epididymitis and Orchitis from Muscular Strain followed by Tuberculosis of the Epididymis (C. W. Cathcart), 152
- Errata, 336
- Fleming, R. A.*, Case of Idiopathic Tetanus (*Cl. Rec.*), 53
- Foggie, W. E.*, A Case of Peripheral Neuritis occurring in Pregnancy (*Cl. Rec.*), 250
- Fordyce, William*, Presidential Address to Edinburgh Obstetrical Society, 169
- Forfarshire Medical Association, 126
- Fowler, J. S.*, Three Cases of Decapsulation of the Kidney for Chronic Nephritis (*Cl. Rec.*), 111
- Fraser, John*, Capsule-Stripping Operation for Subacute Nephritis (*Cl. Rec.*), 117
- GALL-BLADDER and Biliary Ducts, Surgery of the (James M. Graham) (*Crit. Rev.*), 254
- Gardiner, F.*, Tuberculosis of the Skin (*Crit. Rev.*), 374.
- Gestation, Human, and our Embryological and Morphological Data (James Oliver), 245
- Graham, James M.*, Surgery of the Gall-Bladder and Biliary Ducts (*Crit. Rev.*), 254
- Greig, David M.*, see Appointments
- "Cardiospasm," Congenital Narrowing of the Œsophagus and Œsophagectasia, 342
- Greig, David M.*, A Case of Primary Brachial Neuritis treated by Stretching of the Brachial Plexus (*Cl. Rec.*), 247
- HAY-FEVER, Animal and Food Idiosyncrasy, and Asthma, Anaphylaxis in Man: Its Bearing upon (Charles M'Neil) (*Crit. Rev.*), 188
- Henderson, G. E. W.*, A Case of Painless Labour in a Primipara (*Cl. Rec.*), 186
- Honours, 134
- Human Gestation and our Embryological and Morphological Data (James Oliver), 245
- Hydrocephalus and Intracranial Tumours, Recent Advances in the Diagnosis and Treatment of (W. Q. Wood) (*Crit. Rev.*), 121
- Hydronephrosis, A Case of Double Congenital (Johnstone and Browne) (*Cl. Rec.*), 369
- Hypertrophy, Congenital, on the Pylorus (John Thomson), 1
- IDIOPATHIC Tetanus, Case of (R. A. Fleming) (*Cl. Rec.*), 53
- Idiosyncrasy, Animal and Food, Hay-Fever and Asthma, in Relation to Anaphylaxis in Man (Charles M'Neil) (*Crit. Rev.*), 188
- Influenza, A Study of the Pneumococcus and Streptococcus Groups in their Relation to (W. R. Logan), 294
- Intestinal Tuberculosis (F. M. Caird), 73
- Intracranial Tumours, Hydrocephalus and, Recent Advances in the Diagnosis and Treatment of (W. Q. Wood) (*Crit. Rev.*), 121
- Johnstone, R. W., and Browne, Francis J.*, A Case of Double Congenital Hydronephrosis (*Cl. Rec.*), 369
- KIDNEY, Three Cases of Decapsulation of, for Chronic Nephritis (J. S. Fowler) (*Cl. Rec.*), 111

Index

Knox, Robert, Treatment by X-ray and Radium, 273, 348

LABOUR, Painless, in a Primipara (G. E. W. Henderson) (*Cl. Rec.*), 186

Laird, D. A., Carcinoma of the Stomach in a Boy aged Fifteen, 98

Logan, W. R., A Study of the Pneumococcus and Streptococcus Groups in their Relation to Influenza, 294

M'Neil, Charles, Anaphylaxis in Man : Its Bearing upon Hay-Fever, Animal and Food Idiosyncrasy, and Asthma (*Crit. Rev.*), 188

Medical Education, Legislation and Practice in the United States (Norman Walker), 21

Morbidity, Post-operative, in its Relation to General Anæsthesia (H. T. Thomson), 356

Morphological and Embryological Data, Human Gestation and Our (James Oliver), 245

Muscular Strain, Epididymitis and Orchitis from, followed by Tuberculosis of the Epididymis (C. W. Cathcart), 152

NEPHRITIS, Chronic, in Children, Four Cases of, treated by Decapsulation (J. W. Simpson) (*Cl. Rec.*), 115

— Chronic, Three Cases of Decapsulation of the Kidney for (J. S. Fowler) (*Cl. Rec.*), 111

— Subacute, Capsule - Stripping Operation for (John Fraser) (*Cl. Rec.*), 117

— Subacute Diffused, Two Cases of Renal Decapsulation in (Francis D. Boyd), 104

Neuritis, Brachial, treated by Stretching of Brachial Plexus (D. M. Greig) (*Cl. Rec.*), 247, 336

— Peripheral, Occurring in Pregnancy (W. E. Foggie) (*Cl. Rec.*), 250

OBITUARIES—

Barnes, Hy., 337

Robertson, W. L., 200

Simpson, J. W., 198

Obstetrical Society, Presidential Address to (Wm. Fordyce), 169

Œsophagectasia, Congenital Narrowing of the (Œsophagus and "Cardiospasm" (D. M. Greig), 342

Œsophagus, Congenital Narrowing of the, "Cardiospasm," Œsophagectasia, and (D. M. Greig), 342

Oliver, James, Human Gestation and our Embryological and Morphological Data, 245

Orchitis, Epididymitis and, from Muscular Strain, followed by Tuberculosis of the Epididymis (C. W. Cathcart), 152

PAINLESS Labour, A Case of, in a Primipara (G. E. W. Henderson) (*Cl. Rec.*), 186

Parenthood, Problems of Population and (J. W. Ballantyne) (*Crit. Rev.*), 55

Passes, 134, 336, 341

Peripheral Neuritis occurring in Pregnancy (W. E. Foggie) (*Cl. Rec.*), 250

Physical Therapeutics from the Surgical Standpoint (J. Stuart Ross), 232

Plexus, Brachial, Stretching of for Brachial Neuritis (M. D. Greig) (*Cl. Rec.*), 247, 336

Pneumococcus and Streptococcus Groups in their Relation to Influenza : A Study of (W. R. Logan), 294

Population and Parenthood, Problems of (J. W. Ballantyne) (*Crit. Rev.*), 55

Post-operative Morbidity in its Relation to General Anæsthesia (H. T. Thomson), 356

Pregnancy, A Case of Peripheral Neuritis occurring in (W. E. Foggie) (*Cl. Rec.*), 250

Index

- Prenatal Death (Arthur Robinson), 137, 209
- Preventive Medicine, Where do we stand in? (Wm. Robertson), 313
- Psoriasis, Cases illustrating the Influence of Trauma on the Distribution of (W. D. D. Small) (*Cl. Rec.*), 51
- Pylorus, Congenital Hypertrophy on the (John Thomson), 1
- RADIUM, Treatment by X-ray and (Robert Knox), 273, 348
- Recent Advances in the Diagnosis and Treatment of Hydrocephalus and Intracranial Tumours (W. Q. Wood) (*Crit. Rev.*), 121
- Renal Decapsulation in Subacute Diffused Nephritis, Two Cases of (Francis D. Boyd), 104
- Reports of Societies, 126
- Reviews—
- Albee, Fred H., *Orthopedic and Reconstruction Surgery—Industrial and Civilian*, 203
- Arey, *see* Prentiss
- Back, Ivor, and Edwards, A. T., *The Synopsis of Surgery*, 384
- Bainbridge, F. A., and J. A. Menzies, *Essentials of Physiology*, 70
- Balfour, Lady Frances, *Elsie Inglis*, 390
- Ballance, Chas. A., *Surgery of the Heart*, 390
- Barclay, R. Mary, *see* Kraepelin
- Baruch, Simon, *An Epitome of Hydrotherapy*, 206
- Berkeley, Comyns, *A Handbook of Midwifery*, 69
- Berkeley, Comyns, and Victor Bonney, *The Difficulties and Emergencies of Obstetric Practice*, 207
- Birk, Dr, *Leitfaden der Kinderheilkunde*, 130
- Blackman, Col., *Military Sanitation*, 389
- Bland-Sutton, Sir John, *Selected Lectures and Essays*, 131
- Bonney, *see* Berkeley
- Reviews—*continued*
- Boothby, W. M., and Sandiford, I., *Basal Metabolic Rate Determinations*, 381
- Bowlby, A. A., and Andrewes, F. W., *Surgical Pathology and Morbid Anatomy*, 383
- Bram, Israel, *Exophthalmic Goitre and its Non-Surgical Treatment*, 326
- Brickdale, Fortescue, *Text-book of Pharmacology and Medical Treatment for Nurses*, 389
- Brooke, Gilbert E., *Medico-Tropical Practice*, 68
- Buckley, A. C., *The Basis of Psychiatry*, 327
- Burton - Opitz, Russell, *Advanced Lessons in Practical Physiology for Students of Medicine*, 329
- Buxton, Dudley W., *Anæsthetics*, 69
- Chatterji, K. K., *Syphilis in General Practice, with Special Reference to the Tropics*, 66
- Chirurgie Réparatrice et Orthopédique*, 2 vols, 129
- Clarke, R. H., and Henderson, E. E., *Investigation of the Central Nervous System*, 381
- Codd, A., *Induction Coil Design*, 272
- Cope, Zachary, *Surgical Aspects of Dysentery*, 385
- Copestake, Beatrice M. Goodall, *The Theory and Practice of Massage*, 70
- Creighton, Charles, *Some Conclusions on Cancer*, 202
- Crow, Dr, *Pyorrhæa Alveolaris*, 387
- Cushny, A. R., *Text-book of Pharmacology and Therapeutics*, 271
- Da Costa, J. C., *Modern Surgery*, 271
- Dewberry, Mr, *The Destruction and Prevention of Rats*, 388
- Doyen, E., and H. Spencer Brown, *Surgical Therapeutics and Operative Technique*, 267
- Drever, Georges, *The Assessment of Physical Fitness*, 129

Index

Reviews—continued

- Drummond, Margaret, *Five Years Old or Thereabouts*, 127
- Duclaux, Emile, *Pasteur: the History of a Mind*, 128
- Einhorn, Dr, *The Duodenal Tube*, 385
- Emerson, C. P., *Essentials of Medicine*, 388
- Ergebnisse der innere Medizin und Kinderheilkunde*, 131
- Ewart, E. D., *A Guide to Anatomy for Students of Medical Gymnastics — Massage and Medical Electricity*, 384
- Frazer, J. Ernest, *The Anatomy of the Human Skeleton*, 269
- Freyer, Sir Peter J., *Clinical Lectures on Enlargement of the Prostate*, 132
- Gallemaerts, Prof., and Dr Kleefeld, *Étude Microscopique de l'œil vivant*, 330
- Gask, George E., and Harold W. Wilson, edited by, *Surgery: A Text-book by Various Authors*, 268
- Godlee, Rickman J., *Six Papers by Lord Lister*, 387
- Goodhart, James F., *The Diseases of Children*, 383
- Gradwohl, R. B. H., and A. J. Blaivas, *The Newer Methods of Blood and Urine Chemistry*, 131
- Griffin & Co., *Centenary Volume*, 387
- Groves, Hey, *Synopsis of Surgery*, 387
- Gullan, M. A., *Theory and Practice of Nursing*, 272
- Hare, Hobart Amory, *Diagnosis of Disease*, 132
- Henderson, I. F., and W. D., *A Dictionary of Scientific Terms*, 67
- Henry, Robert, and André Demonchy, *Manuel d'Urethroscopie*, 130
- Herschell, G., *Text-book of Indigestion*, 70

Reviews—continued

- Hess, A. F., *Scurvy, Past and Present*, 268
- Hewlett, R. Tanner, and A. T. Nankivell, *The Principles of Preventive Medicine*, 267
- Hofmann, Erich, *Behandlung der Haut- und Geschlechtskrankheiten*, 131
- Horder, Thomas, *Medical Notes*, 387
- Hurst, Arthur, *The Psychology of the Special Senses*, 384
- Hutchison, Robert, *Lectures on Diseases of Children*, 383
- Hutchison, R., and Harry Rainy, *Clinical Methods*, 70
- Ibbotson, Dr, *Atlas of the Sensory Cutaneous Nerves*, 390
- Jameson, W. Wilson, and F. T. Marchant, *Hygiene*, 205
- Jansen, Murk, *On Bone Formation: In Relation to Tension and Pressure*, 380
- Jardine, Robert, *Practical Text-book of Midwifery for Nurses*, 386
- Jex-Blake, A. J., *Physical Signs in the Chest and Abdomen*, 385
- Kelly, H. A., *American Medical Biographies*, 391
- Kerr, I. M. Munro, and Jas. Hendry, *Notes on Midwifery*, 390
- King, W. G., *Vaccination in the Tropics*, 70
- Kleefeld, see Gallemaerts
- Kraepelin, Emil, translated by Mary Barclay, *Manic-Depressive Insanity and Paranoia*, 327
- Lapage, C. Paget, *Feeble-mindedness in Children of School Age*, 270
- Lumb, Norman, *The Systematic Treatment of Gonorrhœa in the Male*, 68
- MacCallum, W. G., *A Text-book of Pathology*, 332
- M'Kenzie, Dan, *Diseases of the Throat, Nose, and Ear*, 382
- M'Laren, Eva Shaw, *Elsie Inglis*, 390

Index

Reviews—continued

- MacLeod, I. M. H., *Diseases of the Skin*, 328
 M'Murich, Prof., *Development of the Human Body*, 390
 Mann, M., *Text-book of Tracheo-Bronchoscopy*, 385
 Marchant, *see* Jameson
 Martin, Edward, B.A., Thomas and S. W. Moorhead, *White and Martin's "Genito-Urinary Surgery"*, 269
 Martindale, W. H., *The Extra Pharmacopœia*, 133
 Maublanc and Ratié, *Medical Examination of Airmen*, 386
 Mayou, S., *Diseases of the Eye*, 69
 Medi, J. P., *Elements of Hygiene and Public Health*, 390
 Medical Research Council, *The Diagnosis and Treatment of Peripheral Nerve Injuries*, 380
 Mennell, James B., *Massage: Its Principles and Practice*, 69
 Midwifery, by Ten Teachers, 206
 Murray, Flora, *Women as Army Surgeons*, 388
 Nankivell, A. T., *see* Hewlitt
 National Anæsthesia Research Society, *Nitrous Oxide Oxygen Analgesia*, 386
 Osler, Wm., *Principles and Practice of Medicine*, 388
 Park, Wm. Hallock, edited by, *Public Health and Hygiene*, 267
 Parker, G., *The Early History of Surgery in Great Britain*, 271
 Pitzman, Marsh, *The Fundamentals of Human Anatomy*, 383
 Porter, Charles, *School Hygiene and the Laws of Health*, 271
 Potter, *see* Wilson
 Powell, R. D., and Hartley, P. H. S., *Lungs and Pleuræ*, 384
 Prentiss, C. W., and L. B. Arey, *Text-book of Embryology*, 333
 Pritchard, Eric, *Infant Education*, 383

Reviews—continued

- von Reuss, Dr August Ritter (Translation revised by J. D. Rolleston), *The Diseases of the New Born*, 325
 Rivas, Damaso, *Human Parasitology*, 204
 Rivers, W. H. R., *Instinct and the Unconscious*, 201
 Rixon and Matthew, *Anxiety Hysteria*, 384
 Roberts, F., *Physiology*, 390
 Roberts, Morley, *Warfare in the Human Body*, 126
 Robertson, T. Brailsford, *Principles of Biochemistry*, 324
 Roger, G. H., and others, *Nouveau Traité de Médecine*, 329
 Rolleston, John D., *see* von Reuss
 Rorie, David, *The Auld Doctor*, 387
 Roth, Paul Bernard, *Orthopædics for Practitioners*, 66
 Rows and Orr, *Functional Mental Illnesses*, 388
 Schmeiden, Prof., *Course of Operative Surgery*, 391
 Sharp, Wm., *Diagnosis and Treatment of Brain Injuries*, 387
 Shears, George S., *Obstetrics, Normal and Operative*, 389
 Sillar and Lambie, *Selected Materia Medica*, 388
 Starling, E. H., *Feeding of the Nations*, 272
 Sternberg, Martha L., *George Miller Sternberg: A Biography*, 391
 Thomson, John, *The Clinical Study and Treatment of Sick Children*, 331
 Tidy, H. L., *Synopsis of Medicine*, 68
 Todd, Alan H., *Lectures on Surgery for Nurses*, 389
Transactions of American Surgical Association, 1919, 391
 Tubby, A. H., *A Consulting Surgeon in the Near East*, 386
 Webb, Curtis, *Electrotherapy*, 272

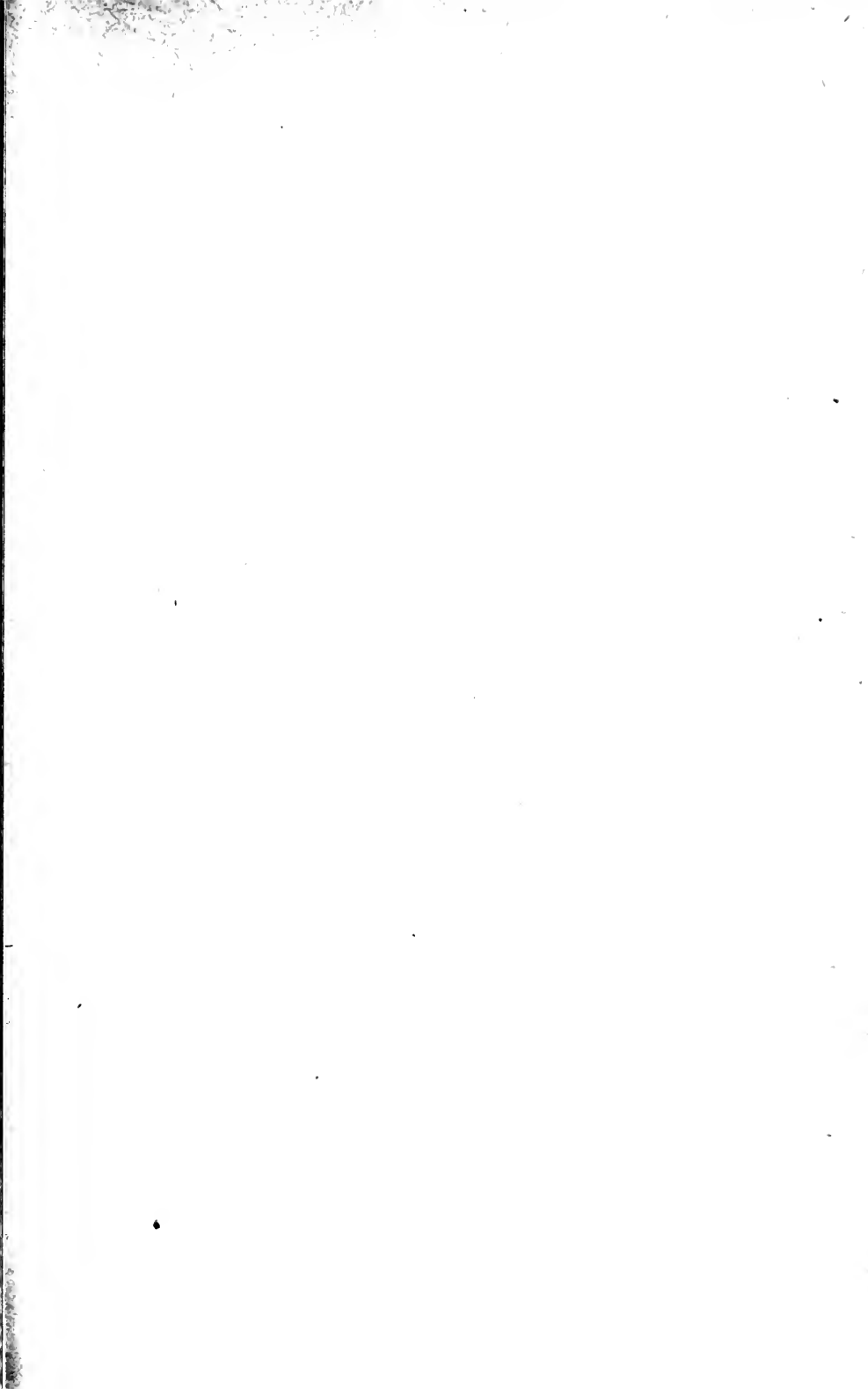
Index

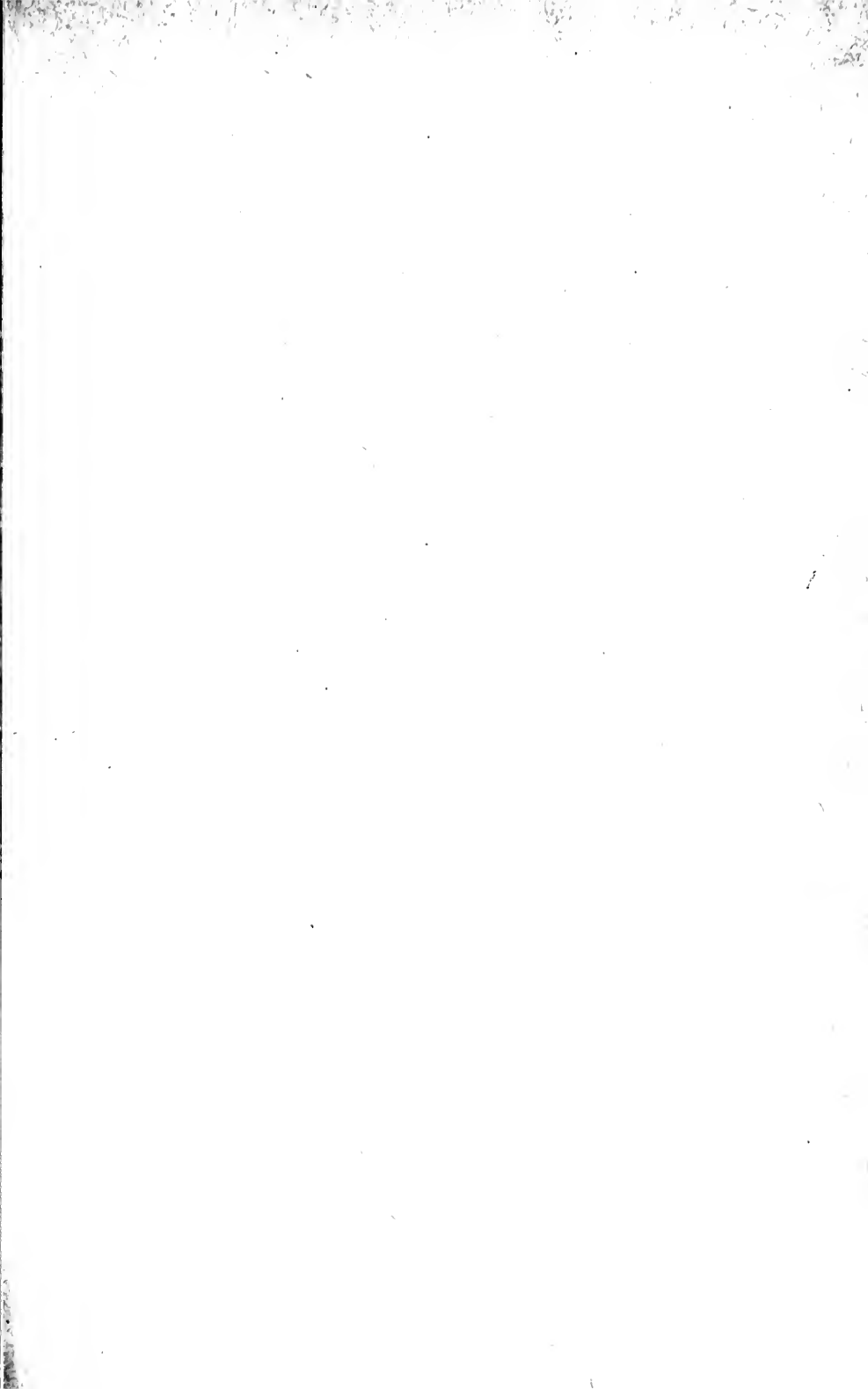
Reviews—continued

- Wilson, Harold W., *see* Gask
 Wilson, J. C., and N. Potter,
Internal Medicine, 334
 Robertson, Wm., Where do we stand
 in Preventive Medicine? 313
 Robertson, William Latto, *see*
 Obituaries
 Robinson, Arthur, Prenatal Death,
 137, 209
 Ross, J. Stuart, Physical Therapeutics
 from the Surgical Standpoint,
 232
 Royal College of Physicians, 134
 Royal College of Surgeons, 134,
 336
 SHENNAN, Theodore, Calmette's Pro-
 tective Vaccination of Cattle
 against Tuberculosis, and its
 possible Application in Man (*Crit.*
Rev.), 318
 Simpson, J. W., Four Cases of Chronic
 Nephritis in Children, treated by
 Decapsulation (*Cl. Rec.*), 115
 Simpson, J. W., *see* Obituaries
 Skin, Tuberculosis of (F. Gardiner)
 (*Crit. Rev.*), 374
 Small, William D. D., Cases illus-
 trating the Influence of Trauma
 on the Distribution of Psoriasis
 (*Cl. Rec.*), 51
 Stomach, Carcinoma of, in a Boy aged
 Fifteen (D. A. Laird), 98
 Streptococcus and Pneumococcus
 Groups in their Relation to
 Influenza: A Study of the (W.
 R. Logan), 294
 TETANUS, Case of Idiopathic (R. A.
 Fleming) (*Cl. Rec.*), 53
 Therapeutics, Physical, from the
 Surgical Standpoint (J. Stuart
 Ross), 232
 Thomson, H. Torrance, Post-operative
 Morbidity in its Relation to
 General Anæsthesia, 356

- Thomson, John, Congenital Hyper-
 trophy on the Pylorus, 1
 Trauma, Cases illustrating the
 Influence of, on the Distribution
 of Psoriasis (W. D. D. Small)
 (*Cl. Rec.*), 51
 Tuberculosis, Calmette's Protective
 Vaccination of Cattle against, and
 its Possible Application in Man
 (Th. Shennan) (*Crit. Rev.*), 318
 — Intestinal (F. M. Caird), 73
 — of Skin (F. Gardiner) (*Crit. Rev.*),
 374
 — of the Epididymis, Epididymitis,
 and Orchitis from Muscular
 Strain, followed by (C. W.
 Cathcart), 152
 Tumours, Intracranial, Hydrocephalus
 and, Recent Advances in the
 Diagnosis and Treatment of
 (W. Q. Wood) (*Crit. Rev.*),
 121
 UNITED STATES, Some Comments on
 Medical Education, Legislation
 and Practice in the (Norman
 Walker), 21
 VACCINATION, Calmette's Protective,
 of Cattle against Tuberculosis, and
 its Possible Application in Man
 (Th. Shennan) (*Crit. Rev.*), 318
 Vienna, Letter from (*Our Own*
Correspondent), 263
 Walker, James, *see* Honours
 Walker, Norman, Some Comments
 on Medical Education, Legisla-
 tion, and Practice in the United
 States, 21
 Wood, W. Q., Recent Advances in
 the Diagnosis and Treatment of
 Hydrocephalus and Intracranial
 Tumours (*Crit. Rev.*), 121
 X-RAY and Radium, Treatment by
 (Robert Knox), 273, 348

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